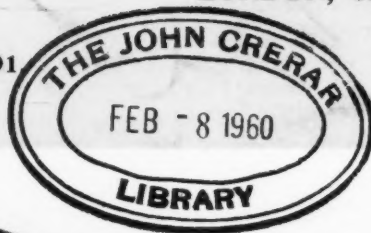


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The Mining Journal

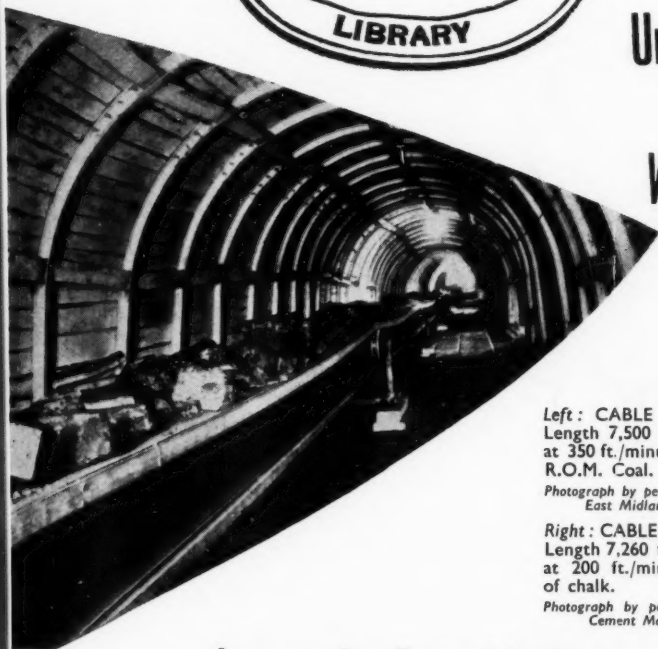
LONDON, JANUARY 15, 1960

Vol. 254. No. 6491



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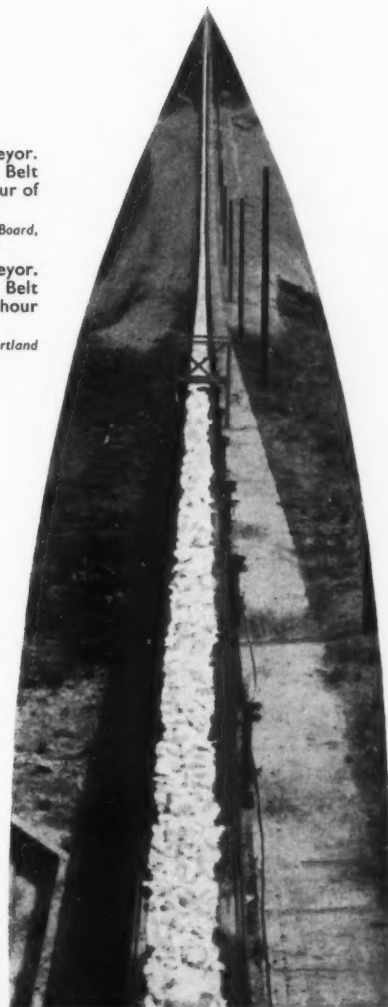
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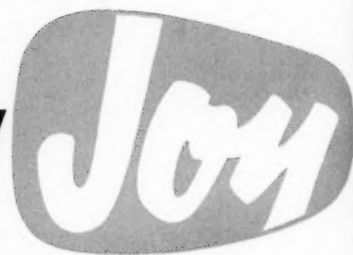


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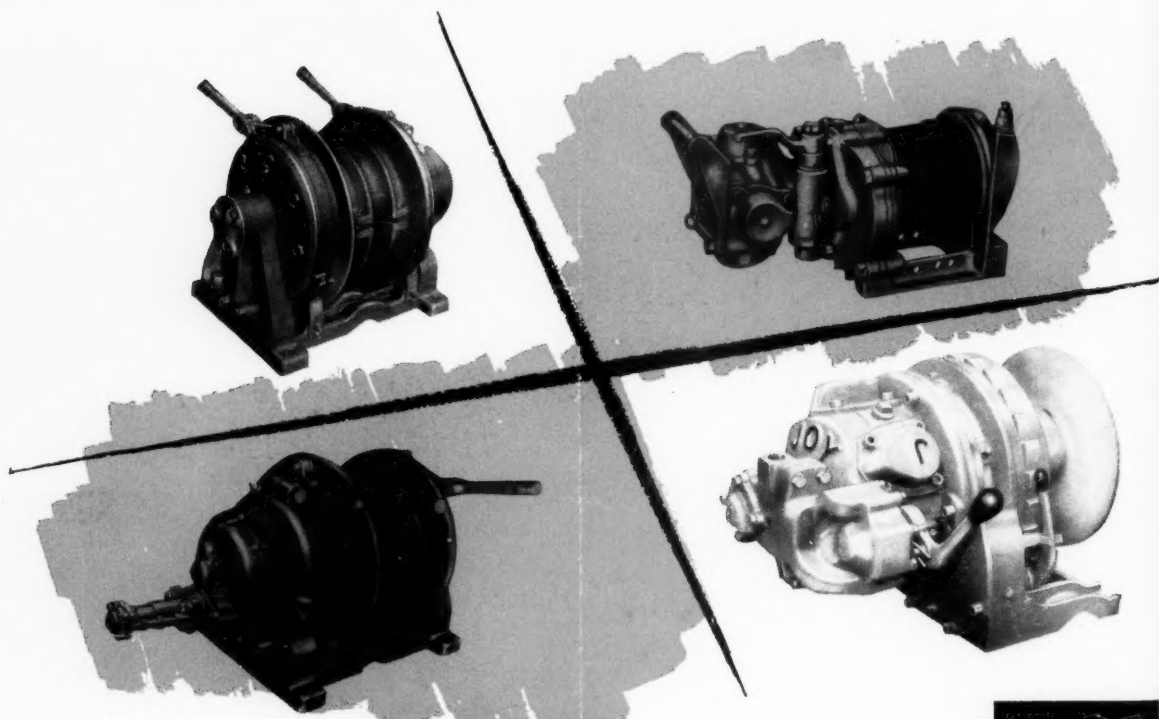
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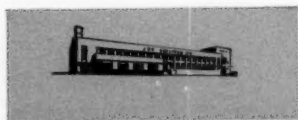
SPECIFICATIONS

Model	H.P.	Rope Pull (lbs)	Rope Speed (F.P.M.)	Rope Capacity			Weight	Overall Dimension			Power
				$\frac{1}{2}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "		Lth.	Wdth.	Ht.	
AW-80	0.9	750	30	286'	194'	127'	85 lb	22"	9 $\frac{1}{2}$ "	11"	Air
EW-111	5.0	2000	70	-	520'	360'	325 lb	24"	15"	19"	Air
F-113	7 $\frac{1}{2}$	2000	124	-	1000'	700'	470 lb	24 $\frac{1}{2}$ "	24 $\frac{1}{2}$ "	20 $\frac{1}{2}$ "	Air
D-113	7 $\frac{1}{2}$	2000	125	-	1000'	700'	650 lb	38 $\frac{1}{2}$ "	23 $\frac{1}{2}$ "	20 $\frac{1}{2}$ "	F.L.P. Electric
D-113	10	2600	125	-	1000'	700'	675 lb	38 $\frac{1}{2}$ "	23 $\frac{1}{2}$ "	20 $\frac{1}{2}$ "	F.L.P. Electric

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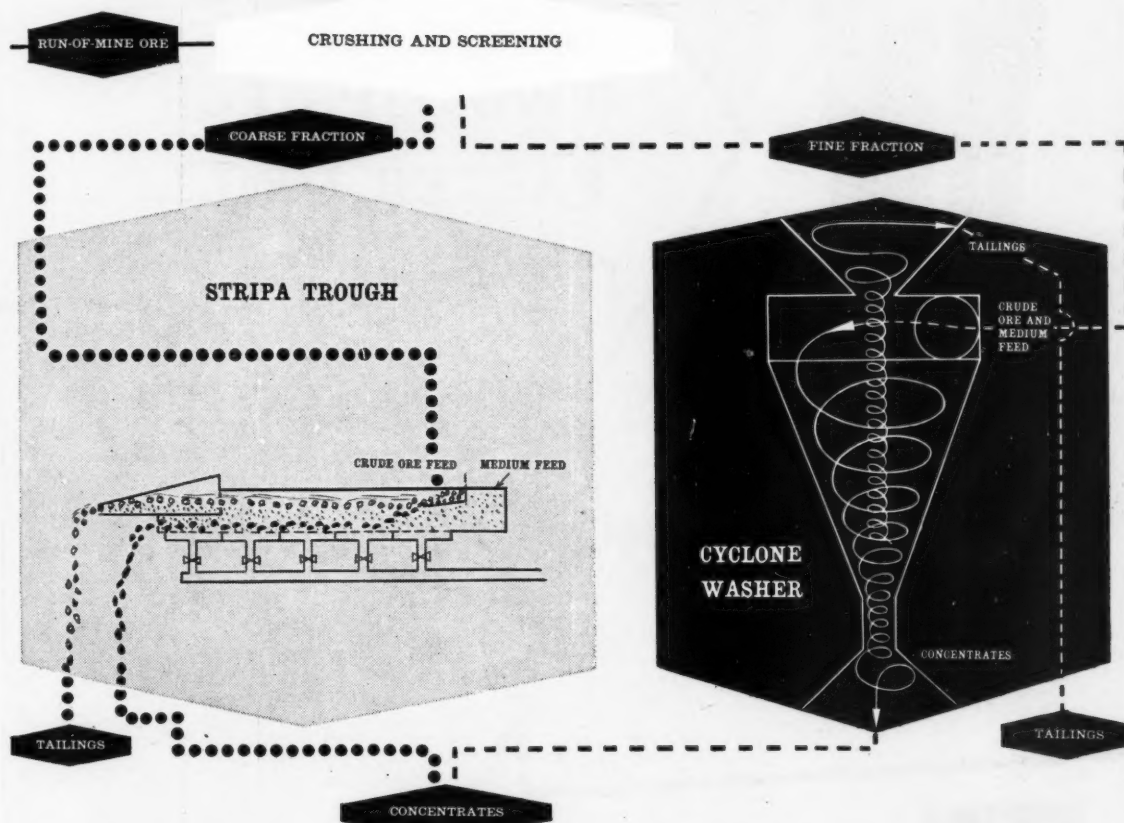
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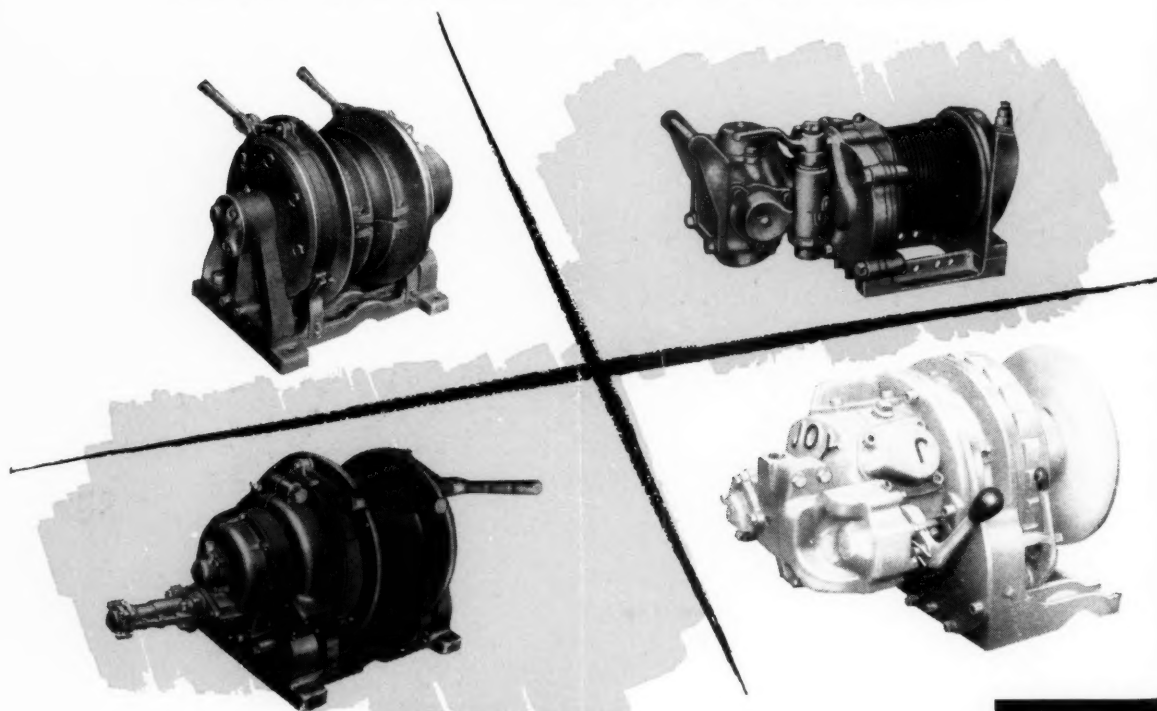
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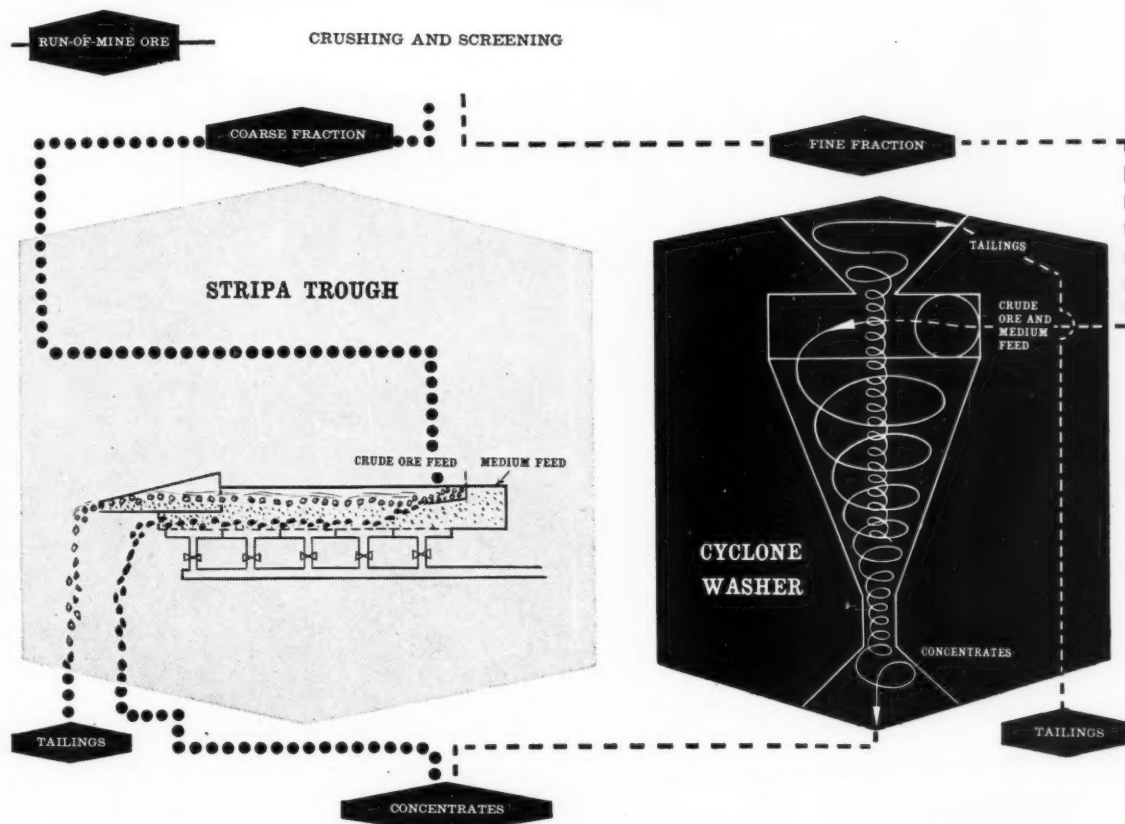
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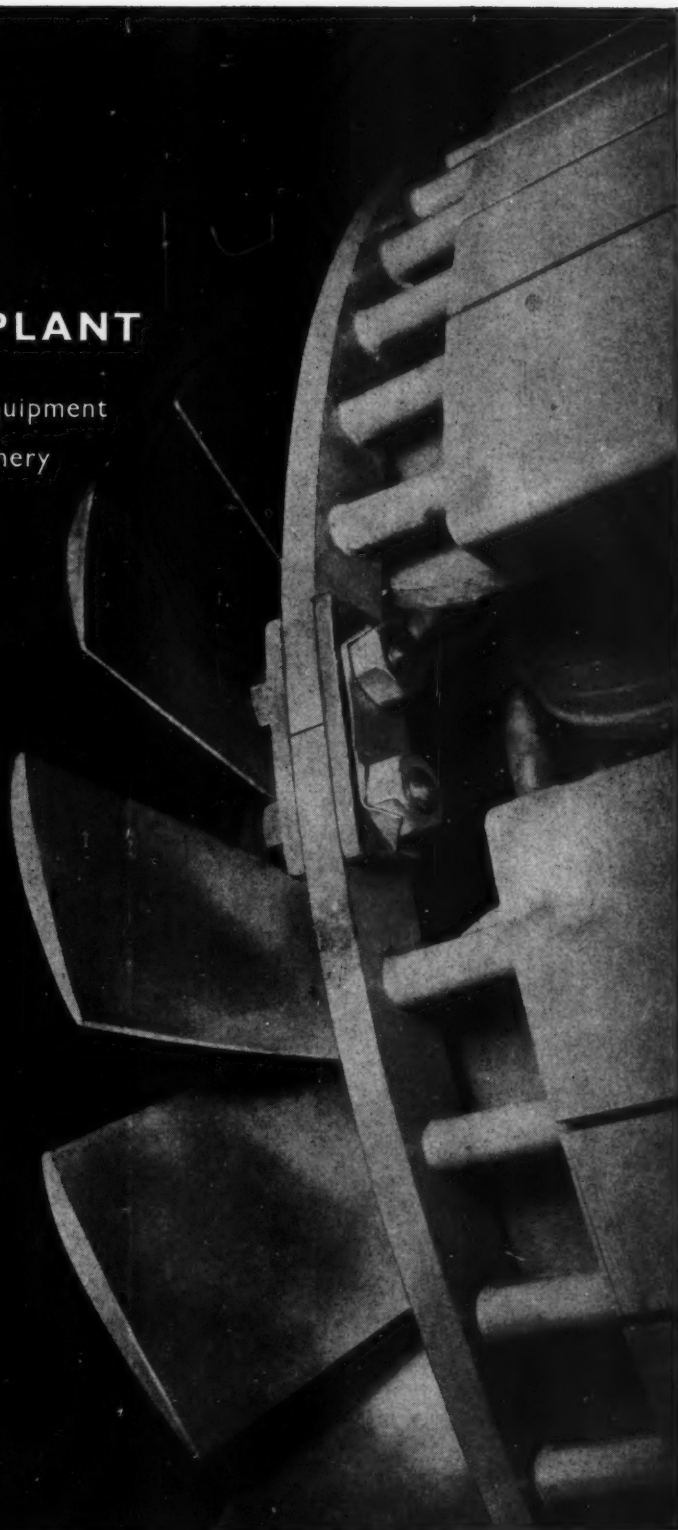
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The Mining Journal

London, January 15, 1960

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Further Expansion Ahead

NOW that the steel strike in the United States, which has been the chief question mark hanging over the short-term outlook, has been finally settled, it becomes possible to indulge with rather more assurance in the seasonal pastime of crystal gazing, bearing in mind that even the most clairvoyant of economic prophets are always liable to be confounded by the unexpected.

Subject to this essential reservation, it can scarcely be gain-said that the barometer of international trade has been steadily rising and that at present there are few clouds on the distant horizon which indicate any speedy reversal of the present trend. Throughout the Free World the aftermath of the recession, save in coal, shipping, and a few other industries which have yet to recover, is being dispelled by a surge of expansion which gives promise of being sustained. International tension is perceptibly lessening; if bombers are not yet being converted into commercial airliners, it can at least be said that the battle of the rival ideologies is currently being fought not with weapons of destruction but with loans and grants, railways and hydroelectric projects, the prize at stake being the support, or at any rate the benevolent neutrality of the uncommitted (and for the most part underdeveloped) nations.

All this adds up to further gains in the consumption of metals, and minerals, which should be reflected by an upsurge of activity in minerals exploration and mine development. Coal's fortunes, now at their lowest ebb, may be expected to take a turn for the better. There is, perhaps, a cloud no bigger than a Treasury official's hand hanging over the United States, where fears of rising interest rates and renewed inflation have already cast their shadow on the Stock Exchange. But it would be a truly heroic Administration that would be prepared to buy financial stability at the cost of depression, particularly in an Election year. The Federal Reserve Board may therefore be expected to watch the economic situation very closely in order to prevent the pendulum from swinging too far in either direction. One of the principal means by which the Administration will seek to ease the pressure of inflation and maintain what it regards as fiscal integrity is through a balanced budget, but this is likely to be achieved without major cuts in expenditure which, as proposed, will total \$79,800,000.

It is, of course, the condition of the American economy which is the largest single factor influencing the metal markets. According to the U.S. National Association of Purchasing Agents, three-quarters of its members expect this year's business to exceed that of 1959, but it is emphasized that this optimistic prediction could be upset by renewed labour troubles, tight money, high interest rates, and foreign competition. Similarly, 70 per cent of Canada's leading companies confidently expect that their sales in 1960 will be well above the 1959 level.

Rising consumption, incomes and investment have been forecast for most Western European countries, including the United Kingdom. The economic recovery in Europe gathered speed during

the spring and summer months, and there were large increases in output in the steel metal using and chemical industries. According to the Economic Commission for Europe, there can be little doubt about the trend in the months ahead, while the risks of a subsequent wage-price spiral appear to be considerably smaller than in comparable situations earlier in the post-war period. The strong balance of payments position of most West European countries, coupled with tariff reductions in several of them and continuing liberalisation of imports, should allow sudden excess demands to be quickly absorbed by increased imports.

So far as individual metals are concerned, it is noteworthy that Mr. Joseph L. Block, chairman of Inland Steel Co., considers that U.S. steel production in 1960 could reach 130,000,000 ingot tons. This would be 13,000,000 tons higher than the record of 117,000,000 set in 1955 and would compare with 85,000,000 tons in 1958 and an estimated 92,000,000 tons last year. The steel strike cut the U.S. production of ferro-alloys in 1959 to a total of 1,950,000 tons, which was nevertheless 13 per cent higher than output in 1958. According to the U.S. Department of Commerce, total production for 1960 should reach 2,700,000 tons, exceeding 1956's all-time peak by approximately 2 per cent. With steel production in other Free World countries at high and rising levels, a favourable year for the ferroalloy metals seems assured and an improvement in the long-depressed chrome and manganese markets can no longer be far off. The expansion of steel production should also give a renewed stimulus to the development of iron ore deposits throughout the world.

The trend of copper demand is traditionally linked with that for steel. Mr. T. E. Veltfort, managing director of the Copper and Brass Research Association, in his annual year-end statement, expressed the view that brass output in the United States would rise by 5 per cent in 1960 to close on 1,000,000 s. tons and that U.S. production of refined copper should reach some 1,500,000 tons. The latter projection, of course, postulates an early end to the protracted copper strike, which has so far resulted in the loss of at least 250,000 tons of metal, thereby solving, at any rate for the time being, the problem of excessive stocks and creating scarcity conditions in the U.S. which hold promise of a very satisfactory price level for other Free World producers for several months to come. Looking further ahead, C.A.B.R.A. predicts a rise in Free World capacity from about 3,860,000 tons in 1959 to 4,369,000 tons in 1963.

The United States Department of Commerce expects that in 1960 domestic demand for lead will show an increase of approximately 3½ per cent over the 1959 estimated figure of 1,100,000 s. tons. This forecast is based on expectations of a moderate increase in requirements for storage batteries, tetra-ethyl lead, pigments and solder. Consumption of slab zinc this year is expected by the Department to be approximately 15-17 per cent higher than the 1959 estimated figure of 940,000 s. tons. Galvanized steel mill products should account for the largest part of this increase. Viewed in conjunction with expanding requirements in other Free World countries, these figures point to a further recovery in lead's statistical position and to the speedy termination of the present voluntary restrictions on production and exports of zinc.

So far as tin is concerned, some estimates, based on present export quotas, foresee the possibility of a surplus of tin supplies in 1960 of as much as 14,000 tons, although other estimates such as in this column two weeks ago point to a substantially smaller surplus. Uncertain factors in the outlook for tin are the availability of Iron Curtain metal and the future of the International Tin Agreement, which expires in mid-year. At worst, the present year should be a much more profitable one for producers than its predecessor.

Assuming no major changes in the general U.S. economy and no serious disruptions within the industry itself, the 1960

outlook for aluminium in the United States is for continued growth which, according to the Aluminium and Magnesium Division, Business and Defence Services Administration, promises a 10-15 per cent improvement in 1960 shipments to consumers over the 1959 volume which in turn is estimated to have been nearly 37 per cent higher than in 1958. Elsewhere in the Free World the outlook is no less encouraging, as is indicated by the recent announcement that Aluminium Ltd. looks to an output of 675,000 l. tons in 1960, or approximately 87 per cent of present rated capacity. Last year production from the Canadian plants was 520,000 tons. (See page 71).

As regards the newer metals, the U.S. Department of Commerce states that tantalum production increased by 25 per cent in 1959 over 1958 and that demand seems likely to continue rising substantially during the present year. There are also indications that the production of columbium metal increased appreciably in 1959 and that extensive research will result in more commercial applications and a further rise in demand in 1960.

He would be a bold prophet indeed who predicted that 1960 would bring the long overdue rise in the price of gold. It can be forecast with confidence, however, that the present year will bring further evidence of the growing popularity of free gold and a further strengthening of the case for an upward revision in price. Meanwhile the gold mining industry, assisted perhaps by some easing of the upward pressure of working costs, will continue to gain further ground.

ELECTRIC POWER FOR CHILE

The World Bank has approved a loan of \$32,500,000 for the further development of electric power in Chile. The larger part of the loan will help to finance a 280,000 kW hydroelectric plant to serve central Chile, which contains the leading centres of industrial, commercial and agricultural activity. The remainder will help to finance a 15,000 kW thermal electric plant in Northern Chile especially to supply power to the iron ore mines there.

Girard Trust Corn Exchange Bank and Grace National Bank of New York are participating in the loan, without the World Bank's guarantee, to the extent of \$175,000, representing the first maturity and part of the second which fall due April 15 and October 15, 1963.

The loan was made to Empresa Nacional de Electricidad, S.A. (Endesa) and Corporacion de Fomento de la Produccion (Fomento), as co-borrowers. Endesa is a joint stock company, owned almost entirely by Fomento. It was established in 1944 to plan electric power developments in Chile and to provide power facilities which cannot be provided by private companies. Fomento is a government agency responsible for promoting economic development in Chile.

The plant serving central Chile will be situated on the Rapel River, about 75 miles (120 kms.) southwest of Santiago. In this part of Chile industrial power consumption in 1958 accounted for 45 per cent of the total. The main industries are a steel mill, pulp and paper mills, coal mines, carbide and metallurgical industries, cement plants and copper refineries. For many years a shortage of generating capacity in this area has made it necessary to restrict power consumption. As additional power becomes available the annual growth of consumption is expected to rise from 7 per cent to about 14 per cent over the next five years.

The thermal plant in Northern Chile will be built in the town of Huasco. It will be equipped with two 7,500 kW. turbogenerators, and will get its fuel from the Lota and Schwager coal mines for which the Bank made loans totalling \$21,800,000 in July 1957. Transmission lines will be built to supply power to the iron ore mines and to four neighbouring towns. The Huasco plant is scheduled to go into operation by the end of 1962.

The area to be served by the Huasco thermal plant has a relatively small population but additional power is needed for its main industry — mining, principally iron ore, copper and manganese. The high grade iron ore in this area of Chile is a valuable export product and the development of the mines has therefore high economic priority. The existing power plants are now fully loaded and the Huasco plant will provide a firm supply of power for the expansion of mining operations. Consumption of energy in the Huasco area is expected to increase at an average annual rate of 10 per cent : on this basis the expanded system will be fully loaded by 1968.

The two projects being financed by today's loan are an important part of an expansion programme being carried out by Endesa to increase the capacity of its power system by 895,000 kW. by 1969. The programme is coordinated with the expansion planned by two private power companies which are responsible for most of the power distribution in the same area. The total cost of the two power projects is estimated at the equivalent of \$72,300,000

AN ALUMINIUM INDUSTRY FOR NEW ZEALAND ?

In recent years the history of mineral exploitation in New Zealand has been depressing. The gold mining industry has been steadily declining and only a very small number of dredges remain in operation. Production of base metals has been on a very limited scale, while the coal industry, though keeping pace with current domestic demands, has not been making appreciable gains in an expanding fuel market. Interesting possibilities are presented, however, by the uranium occurrences at Buller Gorge, by recent bauxite deposits, and by the various projects which have been mooted for the establishment of a local iron and steel industry based on titaniferous iron sands.

Now comes the news that the New Zealand Government is about to conclude an agreement with Consolidated Zinc of Australia on the first exploratory stage of a £100,000,000 aluminium smelting industry in the South Island. It is expected that the agreement will be signed in Wellington next week, the New Zealand Government having offered to allow the company to construct a hydro-electric power station with a capacity of up to 650 mW. The agreement is expected to provide for a detailed engineering appreciation of the Te Anau Manapouri lakes system from which the power would be derived.

The company's searches, not only in Australia itself, but ranging as far afield as New Guinea and even North America, have apparently failed to find cheaper and more abundant sources of power than New Zealand can offer.

In view of the Australian regulations prohibiting the shipment of raw bauxite, it is proposed that the raw material from the huge Queensland deposits should be converted on the spot to first-stage alumina, which would then be shipped to New Zealand for smelting. An ultimate output amounting to 250,000 l. tons of refined aluminium annually is foreseen. According to the New Zealand Minister of Works, Mr. Hugh Watt, total investment in the power plant and smelter, together with subsidiary and servicing industries, might eventually reach £200,000,000. Last year preliminary discussions took place in both countries between representatives of the New Zealand Government and the two companies concerned, namely Consolidated Zinc and its subsidiary, the Commonwealth Aluminium Corporation.

Meanwhile New Zealand's own bauxite resources have been under investigation by the Department of Scientific and Industrial Research and were the subject of an important paper presented in September last year at the New Zealand Mineral Conference in Dunedin, which was attended by some two hundred delegates representing private New Zealand industry and Government departments, as well as major

Australian mineral interests and the Canadian, Soviet and Australian Governments.

The author of the paper in question, Dr. L. D. Swindale, of the D.S.I.R. Soil Bureau, has studied the mineralogy of red-brown loam soils derived from basic rocks, mostly in the Auckland province. In some of these, the amounts of gibbsite, the crystalline trihydrate of aluminium, were found to be high enough for the soils to warrant investigation as possible sources of aluminium. Samples from 58 sites were tested for extractable alumina in the standard Bayer caustic digestion bomb—a laboratory simulation of the simplest commercial process for purifying alumina before smelting. Seventeen samples yielded more than 20 per cent extractable alumina, of which seven graded more than 30 per cent. The total alumina in these samples averaged approximately 40 per cent, with low silica and with ferric oxide generally between 20 and 30 per cent.

Dr. Swindale considers it probable that the Pedersen alumina refining process could be operated economically, if the deposits represented by some of the samples proved sufficiently extensive. The soils which showed the greatest bauxite potential covered an area of five square miles. The depth has not been established, but a drilling and sampling programme has been planned. Deposits containing bauxite clays cover an additional area of about thirty square miles. The soils occur on easy rolling land in well-roaded areas, and tend to have little natural fertility. An unusual feature of the possible mining operations could be rejuvenation of the land by exposure of less weathered material.

Dr. Swindale was not prepared to disclose the location of the bauxite deposits. It was reported, however, in *Chemical Engineering and Mining Review* that, within six days of the presentation of his paper, an Australian mining director who had attended the conference filed in Whangarei, North Auckland, two applications for mineral prospecting warrants. If granted, the warrants would have conferred the exclusive right to prospect for bauxite in specified districts to a maximum of 10,000 acres. New Zealand interests subsequently announced their intention to contest these applications. Meanwhile, however, a bill was introduced in the House of Representatives vesting in the Crown the sole right to prospect or mine for bauxite in certain North Auckland areas. The bill also provides for rights of entry, authority for mining, compensation and royalties.

In the absence of more detailed information as to the terms of the agreement to be signed next week, we do not know whether any provision can be made for the processing of domestic bauxite, if and when it becomes economically available. In view of the New Zealand Government's obvious interest in the potentialities of the local deposits, it would not be surprising if future marketing possibilities had not been discussed with the companies, even at this stage.

CANADIAN SWING BACK TO COAL

The chairman of the Alberta Power Commission said recently that many Alberta power plants now using natural gas are contemplating a change to coal to meet increasing electricity needs by industry. It is claimed that large power stations can produce electricity more cheaply using coal than by burning natural gas. Electrical energy undertakings in the province hope to buy shallow coal deposits to be mined by opencast methods. Additional power stations will be erected adjacent to these strip mines.

It is estimated that strip coal can be mined at a cost of less than one dollar a ton, thus undercutting even the cheapest natural gas rates. Calgary Power Ltd., a large electric utility, has already announced plans to switch to coal-fired stations. The company owns large surface deposits of coal near its Lake Wabamun plant, 60 miles west of Edmonton.

MALAYA'S IRON ORE INDUSTRY EXPANDS

PRODUCTION of iron ore in the Federation of Malaya in 1959 is breaking an all-time record, and for the first time in any year has exceeded the 3,000,000 tons mark.

The previous record was 2,972,359 in 1957, for the full year, but in the first ten months of 1959 production had already reached 3,212,710 tons, of which 1,884,700 was obtained from the Dungun mine of Eastern Mining and Metal Company in Trengganu. Johore, the pioneer iron mining state, where the first iron ore mine was opened in 1921, has lost its post-war position of second largest producer, albeit a poor second. In 1958, Johore's production totalled 446,340 tons against Trengganu's 1,708,366. In January to October this year Johore's total of 350,499 tons has been exceeded by Perak with 441,721 tons against 285,818 tons for the whole of last year, and Kelantan with 402,751 tons against 293,717 last year, when iron mining first started in the state. The only other producing state is Kedah, which has already more than doubled its last year's total of 61,060 tons with a ten months output of 133,039 tons.

Japanese Investment

Ever since a Japanese company opened Malaya's first iron ore mine, the Sri Medan mine at Batu Pahat in Johore in 1921, from which 74,250 tons was exported to Japan in the first year, the country's iron mining has been bound up with Japanese interests. All the iron ore exports go to Japan, and much Japanese capital is invested in the industry, mostly, since World War II, on joint ventures.

In 1924, when the Johore mines annual output had reached 271,992 tons, the Japanese company opened up a deposit in Trengganu, which in that year yielded 7,690 tons.

Johore and Trengganu continued to be the only producing states until 1936, in which year the Johore mine won 590,288 tons against its peak of 743,209 tons in 1929, and the Trengganu mine produced its then record of 1,064,259 tons. Perak's high-grade haematite deposits at Gunong Rapat, near Ipoh, came under notice in 1936, but owing to the location entailing transport difficulties in getting large quantities of ore to the coast for shipment these deposits were only worked in a very small way, to provide "ragging" for jigs on tin dredges in the vicinity.

In 1937 the Temangan deposits in Kelantan were developed, again by the Japanese, with a first year output of 49,223 tons, followed by 159,900 tons in 1928. The Japanese opened another mine in Johore in 1939, the Iizuka mine at Endau. In 1940, the country's production reached a pre-war high of 1,962,463 tons. In 1941, up to the time when the Japanese Army entered Malaya, it totalled 1,149,692 tons.

As the mines were abandoned in face of the advancing Japanese Army, steps were taken to damage or destroy installations to deny them to the enemy. The Japanese however, succeeded in getting the large Dungun mine in

Trengganu back into production in 1942, and continued to operate it until March 1944. The bottling up of Japanese shipping from the east coast of Malaya stopped further exports from, and consequently, working at, the Dungun mine.

The Japanese Military Administration ordered ore obtained from the Temangan mine in Kelantan to be smelted locally, and no records of production during the occupation are available. It is only known that 11 tons was exported in 1944.

The Sri Medan mine in Johore suffered much damage in the battle of Malaya, and such plant as was found to be serviceable the Japanese moved into Malacca, for use in bauxite mining. There is no record of any war-time production at the Iizuka mine.

The Machang Stahun manganese ore mine at Kemaman in Trengganu opened in 1922, had produced 1,500,000 tons of iron ore up to the time when, early in 1941, it was shut down due partly to approaching exhaustion of the reserves, partly to financial difficulties and partly to the withdrawal of Japanese personnel.

The rich haematite deposits near Ipoh in Perak attracted much interest by the Japanese Military Authorities who constructed a railway from the site of these hitherto almost neglected deposits to connect with the main line to Taiping, where the ore was transported for smelting. Production started in October 1942 and continued until July 1945, during which period 41,575 tons was removed.

Post-war Developments

After the Japanese surrender in August 1945, the mines were found to be in a very bad state owing to damage inflicted by the defeated invasionists and the depredations of looters. In 1947, the Gunong Rapat deposit near Ipoh started to be worked but only on the pre-war small scale for "ragging". A new company, Eastern Mining and Metals Co. Ltd. was formed to acquire from the Custodian of Enemy Property, the Dungun mine in Trengganu, which was brought back into production in December 1949, with a production in its first month of 7,966 tons. In the meantime the company had recovered and exported 462,000 tons of ore from the Japanese stockpile. Rehabilitation supplies were difficult to obtain but production was increased annually and was again up to the 1,000,000 tons mark in 1952.

Mining on a more intensive basis began at Gunong Rapat in 1953 when from that mine 10,258 tons was obtained, stepped up to 77,765 tons in the following year. The Sri Medan mine in Johore was re-opened in 1954 and produced 10,079 tons in that year, making the total production for Malaya 1,212,780 tons.

The increasing and urgent demands from the reconstructing Japanese iron and steel works, was the cause of much prospecting for iron-ore deposits and a firm application to remove a

small Japanese stockpile at Gunong Jerai in Kedah and to prospect on the mountain's southern slopes was granted in 1953, but the first production of 5,220 tons, was achieved in 1955. Prospectors were busy in Perak, where investigations were carried out at Gunong Panjang north of the Gunong Rapat area, where in 1954 a gravel pump and dragline excavator had been installed, probably the only instance in the world of an opencast gravel pump iron ore mine.

The Dungun mine continued to develop and installed a washing plant for low-grade secondary ore. Later the washing plant was enlarged and research was instituted into the recovery of the fines passing through to tailings.

In 1955 the running down of the small mine at Gunong Rapat reduced the output from Perak to 6,753 tons, but prospecting at Gunong Panjang and other areas near Ipoh was showing signs of success and the development of new areas brought the Perak output to 186,843 tons in 1956.

Active interest was displayed in deposits in Johore, at Bukit Kepong, Pelepah, Jemaluang and in the Endau locality and in 1955, this State produced 132,154 tons, increased to 263,500 tons in the following year. Kedah's output in 1956 went up to 33,901 tons.

Development and expansion at Dungun, continued; its fleet of Euclid trucks was supplemented with Tournarockers for the transport of overburden as well as of the primary and secondary ores. Its stockpiling arrangements at Sura were reorganised and a new Pohlig stacker was installed. The mine's output in 1955 was 1,321,987 tons, out of the total for Malaya as a whole of 1,466,184 tons.

The year 1955, can be said to have set the pattern for the present flourishing iron mining industry in the Federation.

The ex-Japanese mine at Temangan, in the State of Kelantan, was surveyed and a new joint British and Japanese company examined the project. This mine came back into production in 1958.

The upswing in industry in 1959 has brought about a stimulated demand by Japan for iron ore, of which Malaya is her chief supplier.

There were at end of October five companies working iron ore mines near Ipoh in Perak, where the output has risen spectacularly from 28,792 tons in January to 81,788 in October, 1959. Output in Kelantan and Trengganu was affected in October by the need to complete the stripping of overburden before the onset of the monsoon weather, which strikes these two States with much force and makes shipping from the north-east coast of Malaya practically impossible from November to February.

In the nine months ended September 30, 1959, the country exported to Japan 2,957,419 tons of iron ore of a value of M\$78,000,000, compared with 2,035,812 tons valued at M\$49,100,000 in the same period of 1958. The exports for the full year 1958 were 2,591,382 tons, of a value of M\$62,600,000. The export duty on iron ore is 10 per cent *ad valorem*.

Prospecting Operations

The question might be asked whether the Federation of Malaya can continue to produce iron ore at the present rate, especially as nearly 60 per cent of the country's total comes from one mine, which has been in active production for thirty years.

The answer is yes. Although iron ore occurs widely over the country, so far mines have been developed in only five of the eleven states. The aeromagnetic survey conducted over six areas of the country in 1956-57 indicated many new deposits worthy of ground investigation.

The Dungun mine is probably now at or around its peak production and its output may be expected to begin to fall

off in two or three years. By that time the Ulu Rompin mine in Pahang, on which much preliminary work has already been done by Rompin Mining Co., a subsidiary of Eastern Mining and Metals Co. Ltd., is expected to be in production.

A Japanese company, the Ishihara Sangyo Kashi, prospected iron ore deposits in Ulu Sungei Rompin, in south Pahang, in 1936-41. After the Japanese left, the area was geologically surveyed and examined in April and May 1941, and workable deposits were found to occur in the area, at Bukit Ibam, Bukit Sarlong, Bukit Pisagi, Bukit Anger and Bukit Hitam. The survey report estimated the ore reserves in the area at 30,000,000 tons with an iron content of 50-60 per cent. At Bukit Ibam, the report stated that 5,000,000 tons occurred in outcrop and boulder ore and 13,700,000 *in situ*.

The outbreak of Communist terrorist activities in 1948, which were particularly intensive in the dense jungle of south Pahang, delayed post-war investigations until 1953, when Eastern Mining and Metals Co. Ltd. sent in a prospecting team to explore the Rompin River deposits.

Development of Bukit Ibam

The pre-war reports were confirmed and plans were made for developing the Bukit Ibam deposit, which alone is now estimated to contain 30,000,000 tons of ore. By 1958, the mining scheme was decided upon. This includes the construction of a 48-mile railroad from the mine site to the coast, marshalling yards, giant treatment plants, a residential township, and, at the seaward end, an anchorage and wharves.

The first step was to establish a prospecting base at Kamara, a small aborigine settlement, nine miles from Bukit Ibam and 122 miles by river from Kuala Rompin at the river mouth. This camp looks out over a fire blackened jungle clearance stretching to the mine site. Tigers roam at night and herds of wild elephants crash through the uncleared jungle at the borders. Freighting of supplies from Kamara to the mine site is along a switchback mud and bamboo corduroy track which takes at least two hours to traverse in the driest weather. Drilling operations have been going on day and night to locate the depth and extent of the lode. This work is now almost complete and then there will be a period of inactivity during the monsoon. When the heavy rains stop, about the end of March 1960, the construction of the railway will commence, scheduled to be completed in three years. The mine plant will then be installed and production is expected to start sometime in 1963. Present plans are for an initial annual output of 1,000,000 tons, to be stepped up to 2,000,000 or even 3,000,000 tons if demand so requires.

Since the prospecting camp was established six years ago, its 120 occupants have been isolated from civilization. The round trip by river takes 44 hours in favourable weather conditions, an impossible journey when the rains are heavy. In November of this year, the installation of a V.H.F. radio-telephone station, connected with the Kuantan telephone exchange, 44 miles distant in a straight line over the jungle-clad hills, put the camp into communication with the outside world. The radio station is sited on nearby Bukit Mungus which affords an uninterrupted outlook north east to the Kuantan wireless tower.

Meanwhile prospecting is going on in various other parts of the Federation and it may well be that Selangor may join Pahang as a new iron ore producing state. The Federation's expansion in iron ore production does not seem likely to be halted for many years ahead, so long as the demand for the ore exists. A recent statement made following a visit to Malaya of a mission from the Japanese steel industry indicated that Japan intends to raise its imports of iron ore to 4,150,000 tons by 1962 and that the Federation's known reserves were adequate to cope with any increase Japan may make.

COBALT—II

IMPROVED CONVERTER PRACTICE IN COBALT SMELTING

IN the nickel converter refining process, the emitted particles of slag change-over from a chocolate-brown to a green colour, and take the form of small curly-like balls, which indicate that practically no iron remains in the matte. In refining cobalt-nickel matte, the indications for control are on similar lines, but demand greater attention, since apart from the matter of maintaining a definite ratio of iron to arsenic, this is not done primarily to balance the one against the other to facilitate ultimate wet separation. So long as a certain modicum of iron remains while sulphur is being blown off, it functions as a protective medium for the cobalt, which might otherwise oxidize and pass unduly to the toppings. In other words, the charge in the converter is deliberately under-blown, but not to the former extent whereby the product still retained some 10 per cent iron.

The simpler mattes to handle generally are those rich in iron sulphides, i.e. in the region of 60 per cent FeS upwards, since the lengthier exposure to these converter conditions affords greater opportunity for the small arsenic content to be removed. (This removal of arsenic is not essentially an oxidizing one, and differs from roasting and scorifying methods whereby arsenic is successively removed from iron, cobalt, nickel, and copper in this order, from actual speiss.) Up to a certain point, the iron exerts a fixing influence, while the sulphur under proper conditions appears to assist the volatilization of arsenic, partly in sulphide condition, and not necessarily as oxide. This removal is much more rapid than roasting, and differs materially from the earlier system of slowly eliminating this unwanted constituent.

Of the initial constituents of these complex ores, the silica, magnesia, lime, alumina, chromite, and periodically titania, each of which may range from anything up to 8 per cent or slightly more, are almost completely removed in the blast furnace slag. The manganese, sometimes known to reach a large percentage, and copper, largely pass to the converter toppings, together with the vast bulk of the iron, while arsenic and antimony are appreciably volatilized. While arsenic sulphide is understood to volatilize by itself at 700 deg. C. and antimony sulphide at a white heat, this partly depends on their connection with the associated iron, but they do not get the opportunity to pass off in this easy fashion, as they are combined to the cobalt and nickel, and it is only by dint of manipulating the conditions back and forth that a displacement is possible. Accordingly, cobalt-nickel mattes are much more difficult to work in the converter than nickel mattes, and tend to stick in the bottom. Toppings are removed every 15 minutes, followed by testing periods and additions of fresh flux, and with at least eight such treatments, the blow lasts from 2 to 2½ hours.

In view of the considerable amount of toppings removed, in place of the six or seven 5 cwt. ingots resulting as with nickel matte, this cobalt-nickel matte only gives three corresponding ingots.

Concluding Note

This concludes the smelting and initial refining treatment. As distinct from refined nickel matte which contains some 70 per cent nickel and 30 per cent sulphur, the combined cobalt and nickel contents rarely reach 70 per cent. One of the record rich mattes produced contained 24 per cent cobalt, 43 per cent nickel, 28 per cent sulphur, 3 per cent iron, 0.8 per cent manganese, and 0.5 per cent arsenic.

This, however, came from an "arsenic-free" ore containing some 50 per cent manganese. In regular practice, many of the constituents vary very markedly, in view of the inclusion of odd purchased cobalt-bearing residues, and collected speiss-mattes, which in the absence of regular ore parcels, were widely sought for. Many mattes produced contained only 10 per cent cobalt and 35 per cent nickel, and relatively few with 20 per cent cobalt.

The system of "safe-working" or allowing high iron and arsenic contents to persist, was followed for many years where all kinds of materials had to be dealt with, whereas with regular ore consignments, more liberties could be taken. Only a partial matte refining takes place by the former method, whereby copper, manganese, arsenic, and iron in relatively large quantities, besides the frequent appearance of antimony, meant that a large burden was placed on the subsequent wet

By C. C. DOWNIE

extraction. The recovered bulky iron arsenate precipitate, after filtering off, has been known to contain upwards of 0.4 per cent cobalt, involving quite a problem in economical reclamation.

As can be understood, the art in minimizing this bulky residue has two-fold advantages, in providing a smaller total weight to handle, with a relatively trifling amount of cobalt temporarily laid aside, and success depends on manipulation in the converter.

The refined matte sometimes retains a few points per cent of chromium, although it would be expected normally that this constituent would be eliminated in the blast slag. Apart from regular ore sources, by-products containing minute cobalt contents hail from the speiss-matte used in the smelting of tin residues, which are concentrated until they contain from 1 to 3 per cent cobalt, for disposal to the foregoing treatment, and this accounts largely for the presence of antimony. In wet copper extraction from burnt pyrites, cobalt passes to the waste liquors, where it is deposited as a sludge, sometimes containing 5 per cent cobalt, and provides another small source. A number of the rare metals are frequently present in minute amounts, but relatively little appears to have been done about them. Unlike the refined nickel matte, which is pulverized for direct roasting, cobalt-nickel mattes as acquired from the 5 cwt. ingots, are simply broken in a jaw crusher.

This meets the requirements of "customs" smelters, since quite an appreciable amount of this work comprises handling outside materials, converting to a refined cobalt-nickel matte, and returning to the owners. In the final stages the cobalt is separated by select hypochlorite treatment in the wet extraction department, details of which have appeared elsewhere.

CASSIAR

ASBESTOS

ALTHOUGH the existence of a deposit of asbestos ore in the Cassiar Mountains of northern British Columbia near the Yukon border had been known for more than 20 years it remained untouched, because of its inaccessibility, until 1951 when improved transportation and general world economics made development work possible. The property was then staked by four prospectors, and, after being offered to and turned down by an American concern, was later acquired by the Conwest Exploration Co. Ltd., of Toronto.

Initial development consisted of the construction of an 87-mile long all-weather, main gravel road from the Alaska Highway, one of the many access roads now forming a network over Canada's Northland. Eventually, perhaps in two years, this road may form part of one running from the Alaska Highway, by way of Cassiar and Dease Lake to Stewart on the Pacific Coast. When this does happen, the Cassiar Asbestos Corporation will be saved a matter of more than 600 miles of trucking the ore and several loadings and unloadings, doing away with the loading at Cassiar, unloading and then loading on to a train at Whitehorse, Y.T., and again unloading and loading on to a ship at Skagway, Alaska, before the ore even begins its journey to the world's markets. The new road would take the ore directly from the mine and mill at Cassiar to Stewart at the head of the Portland Canal, a natural deep sea-water inlet from the Pacific, where it would be loaded into ships.

At the outset of operations, a small tonnage of asbestos ore was mined and processed in a pilot mine in the autumn of 1952 and, at that time, the rated output was 150 tons a day. Now, after several years of operating, the output is something like 1,000 tons a day.

Initially, the ore was brought down the mountain, from the 6,200 ft. level, by means of trucks over a road six miles in length. To eliminate the long truck haul, however, a flight conveyor with a steel chute was installed to deliver the ore down the steep face of the mountain to an elevation of 4,800 ft. where it was trucked to the mill. This system was in use during 1953, 1954 and 1955 but was then abandoned in favour of an aerial tramline, manufactured and installed by British Ropeways Engineering Co. Ltd., in order to increase production.

Claimed to contain the purest asbestos ore in the world, having the lowest possible iron content of any, including the ore from the Quebec and Arizona mines, the Cassiar orebody is located at an elevation of 6,200 ft. on a spur off the west side of Mount McDame, one of the highest of the Cassiar Range.

The ore occurs as a large lenticular orebody about 500 feet in width and 1,200 feet in length within a serpentine body which dips at an angle of approximately 45 degrees to the east of the mountain. The asbestos fibre occurs as innumerable veins or seams up to three inches in width in the serpentine rock and, in its fiberized form, is technically known as "chrysotile", which is magnesium silicate with chemically combined water. The fibre amounts to about 8 to 10 per cent of the rock in which it occurs.

Originally, mining was carried out by 15-foot benches in the exposed outcrop of the orebody, using Joy TM-400 wagon drills, Elmcoc loaders, TD-14 tractors and International Harvester trucks of a capacity up to 10 tons. However, as the operation progressed it was realised that a waste stripping programme was necessary in order to free the ore that dipped beneath Mount McDame. In late 1956, the pit layout was changed to 30-foot mining benches, all the mining being of the "open face" variety, and additional equipment was purchased to step up the programme.

Currently the equipment used at the mine consists of one 1½-yard Northwest shovel working in the ore and one 2½-yard shovel working in waste. Six Model 802—16-yard Kenworth trucks do the hauling from the shovels.

Under the existing circumstances, the stripping programme calls for the removal of at least 12,000,000 tons of waste to free 8,000,000 tons of ore and, only recently—October 21, 1959—the top of the mountain was blown off to facilitate the removal of the waste material. This called for the use of some 300 tons of explosive.

The drilling is carried out by previously existing Joy TM-500, track-mounted percussion drills, using 4½-inch tungsten carbide bits. However, recently, a Canadian Ingersoll-Rand "Drillmaster" with "down the hole drill", equipped with 6½-inch tungsten carbide bits was purchased and its use has facilitated the employment of 5 inch by 16 inch Dynamex cartridges. It also makes possible the use of the less expensive Ammonium nitrate-fuel oil mix as a blasting agent. Since the introduction of the new drill, the TM-400s are now restricted to toe-holding and secondary blasting.

A tractor-mounted Ingersoll-Rand Crawl-IR drill has been found to be particularly adaptable to drilling on steep and extremely rough terrain and uses 3½-inch tungsten carbide bits.

The ore is transported from the benches by Kenworth trucks to a grizzly and crusher (a new crusher is currently being constructed) and dropped to the head of the tramline by conveyor and chute. When the new crusher gets into operation, the output will be almost doubled. During the summer months a certain amount of truck haulage is necessary to augment the tramline haulage.

Ore for this purpose is dropped down a chute into the area where it is reloaded with a ¾-yard Northwest shovel into 12-ton haulage trucks for transportation to the mill. At the moment, the yearly output of ore production is approximately over 400,000 tons and waste stripping is expected to be in the region of 1,000,000 tons this year.

The normal mining season is from May to October, depending upon the weather conditions, but in any case, mining must cease in the latter month, for, already—when the writer was there in the autumn—there were at least 3 feet of snow at the summit and it was becoming deeper every day. The mine superintendent told the writer he expected to close the mining operations within three weeks. It is a physical impossibility for the miners to work in the open at that altitude during the winter months.

From the upper loading terminal at the 5,800-foot level to the lower station, at an elevation of 3,525 feet, the total length of the tramline is 14,600 feet and it is in two sections. A third section, near the mill, travels around the outside storage area.

By RONALD MORE

Although the maximum capacity is 2,400 tons per day, in actual fact the practical average is about 1,800 tons per day. There are 180 18-cubic foot buckets on the line and these carry an average of 3/4 tons net weight. The tramline ore can be dropped directly into a hopper at the mill where it is crushed, dried and stored in a 110,000-ton dry rock storage building. This particular storage is reserved for the operation of the mill during the winter. An outside stockpile is also built up to a capacity of approximately 70,000 tons to augment the winter tonnage from the third section of the tramline. Operations at the mine and mill are on a 24-hour basis.

At the mill the ore is ground and sieved, a vacuum system, using 130,000 cu. ft. of air per minute, being used to suck the fibre from the sieving process.

At one end of the mill a "Wheelabrator" dust collecting machine is installed which filters the air for recirculation throughout the mill, the actual dust count being reduced to at least 50 per cent below that allowable by the B.C. Workmen's Compensation Board. In addition, the warmth of the machine makes it possible to keep a comfortable temperature in the mill even in the severest winter conditions. Prior to the installation of this machine, milling operations had been severely restricted when temperatures fell below -20 deg. F.

Although in Quebec and Arizona a use has been found for the inevitable tailings which pile up as a result of the milling operations, at Cassiar, the distance involved in moving them precludes profitable use.

British (Turner and Newall) influence is much in evidence

throughout the mine and mill sites, including the tramline installation and power for the mine, mill and township, which is supplied by six Ruston-Hornby diesel-electric motors with a combined capacity of 3,300 h.p., some of which are equipped with exhaust heat exchangers to furnish low-pressure steam for augmenting the plant space heating.

Central heating for the plant site, including all the homes, is supplied from a steam plant consisting of two 150 h.p. Inglis boilers, which may be fired by oil, wood or coal, located half-way between the mill and the township. Fuel oil is delivered as a return-load by the fleet of twelve trucks, each capable of hauling 20 tons of ore to Whitehorse Y.T., which are fitted under the trailer body with 2,500 gallon tanks constructed in three longitudinal sections. These combined trucks are thought to be unique.

A well-equipped heavy-duty garage maintains and repairs all mobile equipment such as shovels, bulldozers, trucks, etc., while there is also a smaller garage at the mine level. Near to the maintenance shop is a combined machine and electrical shop, a carpenters' shop and paint house and a sheet metal shop.

In the township, accommodation is provided for 70 families and 170 single men and women. Seasonal personnel, or hourly workers, are housed in prefabricated summer bunkhouses with a capacity of 321 men. Everything is done to compensate for the remoteness and new applicants for work are screened to see if they are likely to fit into the life at Cassiar.

VENTILATION IN METAL MINES

DIFFERENT inherent characters of ore mining complicate their effective ventilation. Ore mining generally involves a complicated system of shafts, galleries and chutes interconnected with each other. Proper coursing of air in such an interconnected system of mine workings requires a large number of doors, regulators, etc. To maintain all these ventilating appliances in proper condition, a very strict organizational system is necessary. Interference with regulators, doors, etc. is very common in practice and can only be controlled by a proper set of supervising personnel as well as by teaching miners about the importance of such appliances.

Ore mining, specially when the ores are poor, is often carried out without stowing the goaf, resulting in extension of roof cracks and sometimes of the goaf itself, up to the surface. A large quantity of leakage air may circulate through such old goaves, rendering the control of mine ventilation difficult.

When an ore deposit is large and its hanging wall is strong, the method of mining chosen often involves formation of very large open cavities during stoping. Although this reduces the total ventilating resistance of the mine, the velocity of air currents in stopes drops considerably. In a large number of cases, only sluggish air movements have been observed at stope faces. This is not only disadvantageous from the point of view of dust accumulation, but also creates discomfort.

Regarding the minimum velocity of air current required to carry away the dust from working places, the opinions of

authorities are divided. It has been stated that the minimum velocity must be at least equal to the suspension velocity of the dust particle. The suspension velocity has been expressed by the following formula,

$$v = 28.4 \frac{Y_1 d}{Y_2} \text{ (in metres per second) when } Y_1 \text{ and } Y_2 \text{ are}$$

sp. gr. of the dust and air respectively, and d = diameter of the dust particle in metres.

According to this expression, the theoretical value of the air current necessary to carry away dust particles of sizes above 5 microns is 0.45 m/second, when the specific gravities of the dust material and of air are 4,000 kg./cu. m. and 1.248 kg./cu. m. respectively. In practice, however, it has been found that even air at lower velocities carries away the dust particles of this size successfully. As a rule of thumb, 0.25 to 0.30 m./sec. may be taken as the minimum velocity of air, which should be aimed at to meet the requirements.

Many ore mines are ventilated by natural ventilation alone, but the volume of air flowing through a mine, owing to natural ventilation, fluctuates within a large range, dependent mainly on the air temperature on the surface. Apart from regular seasonal and diurnal variations, any change of weather, e.g. rains, sudden storms, etc., affects the air volume circulated by natural depression to a large extent. In general during the winter months, the volume of air is adequate, whereas in summer, many mines require an additional fan ventilation.

It is interesting to note that in mines where atmospheric air has been cooled on the surface by refrigerating plants and then delivered to the mine, the natural ventilating pressure has been found to be large enough to meet severe ventilating demands. In the Kolar gold mines of India, for example, the atmospheric air is cooled to about 5 deg. C. on the surface before

This is the concluding instalment of an article by Samar Bandyo.

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it enters the mine. Although the mine workings have reached a depth of 3,000 m. below the surface, natural ventilating pressure suffices for adequate ventilation. In all of these mines main mine fans could be dispensed with.

To reorganise the ventilation of an ore mine, it is important to carry out a ventilation survey first. In any case, an air-volume survey must be carried out to detect leakage and short circuits, specially through old workings and goaves. All these leakage paths should be sealed up and all entrances to old workings should be blocked. In large old mines, which have been worked for many years, this may prove to be a very costly affair, unless the positions of such stoppings and dams are chosen cleverly to keep their number to a minimum. Brick and concrete stoppings are liable to develop cracks and to break under roof pressure in course of time, thus allowing a considerable leakage. Rubbish dams may prove to be economical in the long run. Satisfactory dams of this nature may be erected cheaply and quickly by means of small pneumatic stowing machines.

Ascensional ventilation has generally been practiced in stopes to utilize the normal tendency of air to move from a lower to upper level due to natural ventilating pressure, but this may not always be the better choice from the point of view of dust suppression. In extensive experiments performed in coal mines (Table 1), for example, it has been noted that the dissemination of fine coal dust may be considerably reduced by changing the nature of ventilation from ascensional to descensional. Although similar observations have been made in some ore mines, large-scale experiments have not so far been made to prove that this holds good for all methods of mining.

Experiment No.	Air Volume cu. m./min.	Air Velocity m./min.	Dust concentration in air mg./cu. m.	Per cent. of Quartz in air-borne dust	Nature of Ventilation
1	370	36	165.1	11.0	ascensional
2	370	36	166.8	19.0	ditto
3	290	33	39.9	26.8	descensional
4	290	33	45.3	25.5	ditto
5	350	30	148.4	11.6	ascensional
6	350	30	125.3	32.3	ditto
7	290	36	53.4	18.0	descensional
8	290	36	49.7	26.2	ditto

To utilize the available amount of air fully, all unoccupied working places should be bratticed off so as to concentrate the air to the working places actually occupied. In South African gold mines brattice, timber or stone walls are built along the stope face, when a large open cavity is formed in the stope. The whole of the available air is coursed between these walls and the face, and in this way a reasonably high air velocity at the stope face can be assured. In the case of stowed stopes, the space between the stowing face and stope face should similarly be kept at a minimum.

In most of the ore mining layouts, it is not always possible to course the air, which has been used to ventilate a stope, directly to the main return airway. Often the air from one stope or working place must be used to ventilate another stope or working place. The air from the first place, may, however, be so laden with fine dust that inhalation may be harmful. In such cases, a dust collecting unit should be installed between the two places to make the air comparatively dust free. Such units may be wet or dry. In wet units, water is brought in intimate contact with the air to collect the dust, and in dry units, the air is passed through filter cloths of adequate surface area. In both cases, it is important to ascertain the effectiveness of the unit by actual measurements, and not by eye judgment. Many units have proved to collect coarse dust satisfactorily, although they let fine dusts, which are really

dangerous and cannot be seen by naked eyes, escape into the air. The wet units show a sharp fall in collecting efficiency, when a larger amount of air is forced through them than that for which they are designed.

Measuring Equipment

To maintain a check on the dust conditions in working places, each mine should be equipped with reliable and practical dust measuring apparatus. Of all the measuring apparatus available, tyndalloscope appears to be most suitable for routine measurements, its advantages being,

- spot readings directly at the working place, so that no laboratory work is necessary,
- does not require very skilled personnel,
- sufficiently accurate for normal requirements,
- measurements may be made quickly and simply.

In tyndalloscope, a light ray is sent through the sampling chamber containing the dust-laden air. The amount of light reflected by the dust particles is measured. From this the concentration of dust in mg. per cu. m. may be read out of standard tables. The relation between the amount of light reflected by the dust particles and their concentration expressed in weight per unit volume of air depends on the nature of the dust, specially on its light reflecting properties and specific gravity. The types of dusts found in different working places of a mine depend on the rock in which work is being done. Thus, once the nature of dust produced by the orebody itself, by the hanging as well as foot wall, has been ascertained by laboratory tests, they may be taken to hold good for all following measurements, as they have been found to remain the same within the area of a mine.

Another factor affecting the results of tyndalloscope measurements is the presence of fog in the air to be sampled. Such fogs have been noticed when the relative humidity of the air exceeds 78 per cent. Under such circumstances, a tyndalloscope generally shows higher dust concentrations than that actually present. This inaccuracy can be countered by attaching two drying shells on two walls of the sampling chamber. The shells contain a chemical dust having a composition of 95 per cent Fe and 5 per cent ammonium chloride. To this mixture, 1 per cent copper chloride is added to act as catalyst. Just before use, the chemical powder is moistened with a definite quantity of water. Owing to the exothermic reaction that follows, the powder attains a temperature up to 100 deg. C. Due to the heat radiated from the hot shells, the temperature of air in the sampling chamber is raised by about 10 deg. C., resulting in a decrease in the relative humidity. The results then obtained correspond very nearly to the true values. The chemical mixture must be replaced after about eight hours of use. In place of the chemical mixture mentioned above, silica gel has also been used with success to absorb the extra moisture from the air.

As far as important dust measurements in connection with industrial experiments and researches are concerned, the tyndalloscope alone cannot deliver very accurate results, and other apparatus, e.g. konimeter, thermal precipitator, midget impinger, etc., should be used in conjunction with it.

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Machinery and Equipment

British Mine Winding Equipment Installed

The installation in 1957 of a 7,000 h.p. English Electric vertical Francis water turbine, which doubled the output of the Laurie River hydro plant, Manitoba, has enabled considerable re-organization and expansion to be made at the Lynn Lake nickel-copper mines of Sherritt Gordon Ltd. The Laurie River plant is the only source of power for the area.

At the Lynn Lake mines a new shaft was sunk, with an initial depth of 2,000 ft., and two Ward Leonard mine winders have just gone into service. The electrical parts of these winders were supplied by English Electric. Both are of the conventional double drum type, with one fixed and one clutched drum.

The larger winder handles the ore output and operates with balanced bottom opening skips from four underground levels. The rope speed is 560 ft. per min. The 700 h.p. winder motor, with a speed of 435 r.p.m., is fed from a motor generator set consisting of a 575 kW. generator coupled to an 800 h.p. 720 r.p.m. induction motor. Push button automatic control is used.

The cage and counterweight service winder is driven by a 450 h.p. 346 r.p.m. motor supplied by a 375 kW. generator coupled to a 500 h.p. 720 r.p.m. induction motor. The rope speed is 1,080 ft. per min.

Because the shaft will be extended within a few years to a depth of 4,100 ft. provision has been made for a further motor and motor generator set to be added to each winder. The rope speeds will then be increased to 2,040 ft. and 1,500 ft. per min. The original winders at the Sherritt Gordon Mines, also using English Electric equipment were supplied almost 30 years ago and are still in service at the older shafts.

The mechanical parts of all the winders were supplied by Fullerton, Hodgart and Barclay Ltd. of Paisley, the main contractors.

DIRECT ACTING WATER PUMP

Recently developed by Richard Sutcliffe Ltd., is a direct acting water pump for use where water is required at high pressure. A typical and growing use for these pumps is the energization of ramming gear on armoured chain face conveyors, where use is made of mine water to which soluble oil has been added to minimize corrosion. The Sutcliffe pump meets this need, and at the same time eliminates the cumbersome treble ram pump. It has as its basis a self-contained power pack, in which an electric motor drives a rotary oil pump which supplies oil at pressure to two double acting cylinders, the piston of which is connected to a yoke driving the piston of the water pumping cylinder. As the oil cylinder is provided with an automatic instantaneous reversing valve, the delivery of water is maintained practically continuously and in an unvarying quantity. As the whole of the equipment is mounted on the power pack, movement as the face advances is a very simple operation.

The pumping equipment consists of a galvanized tank to hold 100 gal. of mixture. On the tank cover is mounted a $7\frac{1}{2}$ h.p. x 1,500 r.p.m. motor. The motor drives an hydraulic oil pump, the fluid from which drives a reciprocating ram. The latter will reciprocate a water ram to give an output of 5 g.p.m. at 1,000 p.s.i. Relief valves and filters are fitted on both the oil and water circuits. A pressure gauge is fitted in the water line.

RADIO LOCATION OF VENT HOLE

In connection with a project to rehabilitate an old mine in the Front Range mineral belt of Colorado, United States, a large diameter 1,670 ft. ventilation drill hole from the surface was located as it approached bottom at tunnel level by radio triangulation.

It had been planned to longhole a closely spaced grid of horizontal holes at the tunnel level so that the location of the hole could be determined as it approached bottom. This would increase the target area and drain the vent hole.

Powered by a 12V automobile battery, the transmitter consisted of a 6L6 electron-coupled oscillator and amplifier. It had a tuneable oscillator covering the frequencies 200 to 240 kc. and a tuned plate circuit. A tuned antenna was lowered into the hole to concentrate the signal. A Heath DF-2 direction finding receiver was used.

To locate the bottom of the vent hole an automobile was driven close to the collar of the hole and the transmitter connected to the car's battery. The potted, tuned antenna, mounted in a probe, was then lowered to the bottom of the hole, which was then 1,625 ft. deep and filled with water up to 1,500 ft. The transmitter was then tuned to 215 kc., the resonant frequency of the

tuned antenna, readings being taken of both the null and maximum at each of several stations in the tunnel and intersecting drift. The signal picked up by the receiver through 60 ft. of rock was very strong. A check was also made from a small stope. The survey showed that the hole was directly above the drift, and 12 ft. east of the tunnel. Allowing for drift as the hole continued down, the radio survey was accurate to 1 ft.

The technique was applied by the Creek Mining Co. with the assistance of the Bureau of Mines and U.S.G.S. In addition a borehole survey was conducted by Eastman Oil Well Survey Company.

TRANSFORMATION PRINTER

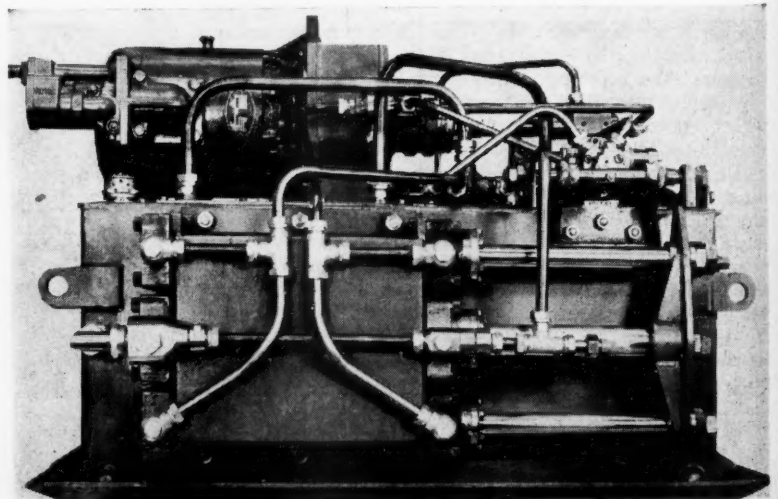
Hilger and Watts have recently introduced a projection transformation printer for making diapositives from negative roll-film. It meets most photographic requirements, particularly those for the plotting of aerial surveys.

Projection printing is claimed superior to contact printing for three reasons:

- (1) It avoids the risk of distortion in clamping a diapositive in a contact printer.
- (2) By using an aspherical correcting plate, it can compensate for distortion by the camera lens.
- (3) If the principal distance of the camera differs from that of the plotting equipment, it allows the scale to be adjusted.

The new printer transforms format sizes between 9 in. (23 cm.) square and 7 in. (18 cm.) square and can be set to any ratio between 2:3 and 3:2. Its body inclines towards the operator and has handwheels for winding the film in

The direct acting water pump for mining applications where water is required at high pressures, manufactured by Richard Sutcliffe Ltd.



either direction. The negative images are projected upwards from the bottom.

Spooled film up to 9.5 in. (24 cm.) in width and 500 ft. (150 m.) in length can be accommodated.

WORLD'S LARGEST MOLE TUNNELS

Now being adapted to production mining, what is claimed to be the world's largest continuous tunnel-boring machine is being used to drive 29½ ft. dia. power tunnels through shale at the Oahe Dam on the Missouri River, near Pierre, S.D., U.S.A.

Since, in the cutting of the diversion and power tunnels of this site, no blasting was permitted because of the unpredictable nature of the underlying shale strata, the contractors for the initial diversion phase, F. K. Mittry Constructors, Los Angeles, Cal., used a 25 ft. 9 in. dia. mole designed by James S. Robbins and Associates, Seattle, Wash., to bore six 1,800 ft. tunnels at a maximum rate of 12 ft. per hr. producing 480 tons of broken rock.

So successful were these that the contractors for the seven power tunnels, Morrison - Knudsen - Kiewit - Johnson ordered a 29½ ft. dia. machine, for which a similar speed is expected. This machine, which weighs almost 200 tons and is 55 ft. long, consists of two principal parts: cutter head and a jumbo structure fuselage or main body. The cutter head houses eight cutting arms on its face, while eight additional cutting devices operate on an outer rim, which also carries buckets to remove the spoil. A shield behind the revolving cutter head confines the rock close to the face of the tunnel. Spoil carried by the buckets to the top of the head is dumped onto a conveyor running through the fuselage and out of the tunnel.

During the two-way cutting procedure, drag-type tungsten-carbide bits attached to the cutting arms in tapered sockets cut grooves or kerfs into the tunnel facing as they travel in circular paths. Disc-shaped rotary cutters of hard-faced steel alloy, mounted behind the fixed tools, also cut concentric circles on the tunnel face, but between the kerfs made by the stationary bits, and the pressure shatters the core between the kerfs well below the point of contact of the discs.

Experience with the smaller models showed that the rotary cutters seldom required replacement, but the fixed tools needed regular replacement, though this was at a cost of less than \$5 per ft. of tunnel.

Not only does the fuselage house the spoil conveyor system, but it carries a special jig and mechanical delivery system for the steel tunnel ribs which are installed concurrently with the advance of the machine, and it also houses the two 400 h.p. motors which provide the power for the cutting machine. Hydraulically operated side jacks on hinged arms push the machine forward against the tunnel ribbing and the wall. Expanding shoes in the shield of the cutter head grip against the walls for stability. The machine is electrically operated by one man using a control console and located in a protected compartment directly behind the cutter head. A special electrical leakage detection device automatically shuts off all power at a certain danger level.

Technical Briefs

Cleaning of Fine Coals

The Convertol process, first described in Germany by Muschenbain in 1952, has recently been studied by S. C. Sun and W. L. McMorris at the Pennsylvania State University in order to determine the relative effectiveness of various oils and hydrocarbons used and at the same time to ascertain the behaviour of coal pulps under various operational conditions and to compare the Convertol process with flotation in the recovery of fine coals.

The process is perhaps akin to coal amalgamation, relying on the phase inversion or agglomeration of oil coated particles which can be separated from the slime waste material by screening or centrifuging.

These investigations have shown that the agglomerating power of the reagent used can be roughly predicted from its specific gravity. In other words the oils with large molecules are too viscous to be dispersed and the light hydrocarbons with much smaller molecules are not sufficiently hydrophobic.

The quantity of oil used is high being between about 2 and 6 per cent and an optimum quantity has been found for different grades. Increase in the amount of heavy oil actually reduced the recovery, whilst in the case of medium weight kerosene, the recovery increases rapidly in the range of 2 to 6 per cent but further increase only increases the recovery of combustible material slightly. It is also shown that the optimum density is usually from 15 to 30 per cent solids depending on the oil used, the optimum time for phase inversion is 1 to 2 min. at 11,000 r.p.m. but that optimum speed is usually between 5,000 and 7,000 r.p.m.

Flotation could be employed equally as effectively in the coals tested and used less reagent. On the other hand, as other investigators have pointed out, the Convertol process can be economically justified for recovering metallurgical coal because the oil present is beneficial to coke plant operation.

ION FLOTATION WINS METALS FROM SOLUTION

A patent application has been made in the U.S. and 31 other countries by Armour and Co.'s Fatty Acid Div. on a new metallurgical process—ion flotation, a process that may pave the way for the recovery of non-ferrous metals from such solutions as mine waters and dilute leach liquors. Process was developed by Prof. Felix Sabba, Witwatersrand University, Johannesburg, South Africa, and has been viewed in some quarters as a cheap way to win metals from the sea.

Armour considers the sea water conception to be interesting, but is directing research toward mine water applications. Basically the process is the same as mineral flotation, except that no mineral is involved, only the metal ions in solution. Soap, with an affinity for certain metals or metal groups, is bubbled through the metal-bearing solution

where the soap reacts with the metal ions to produce a water-insoluble heavy metal soap which floats to the surface and is skimmed off with other soap bubbles.

A survey of the literature on the heavy metal soaps reveals little or nothing about their reactions with each other—by soap is meant the derivatives of the fatty acids, including the amines. The definition of ion flotation could be enlarged to include not only the soaps, but any frother-collector combination that would produce a concentrate from ions in solution. The possibilities are almost unlimited.

Armour hopes to find soaps that will be selective. Two approaches are open. One is to find selective hydrocarbon soap partners. The other is more difficult, but ideally more desirable, and that is to take advantage of the electromotive series of metals.

For example, suppose that for economic reasons and availability, stearate were chosen as a hydrocarbon partner and an attempt was made to form a soap selective to copper in mine water. Looking through the electromotive series it can be seen that a lithium soap would be useless, since lithium would react with every element in the table. Aluminium, further down the list would be somewhat better since it would eliminate the alkali and the alkali earth metals; but it would still react with many undesirables in the series.

Lead, antimony and arsenic soaps would produce a much cleaner concentrate; but bismuth, just above copper, would appear the perfect soap, since it would react only with copper in acid mine water. One stumbling block in this approach is the relative insolubility of the heavy metal soaps (below magnesium) in water. The reagent soaps could be dissolved and diluted and fed with an alcohol or mineral spirit or blended with a wetting agent that would remain soluble in the solution and not contaminate the product. In the past, mining companies have tried many ways to recover copper from dilute mine water, including ion exchange, without much economic success. Perhaps ion flotation is the answer.

SEMI-CONDUCTORS FROM PLASTIC

An alternative to germanium, silicon and similar inorganic substances is reported to have been discovered by the Institute of Petrochemical Synthesis of the Russian Academy of Sciences. Instead of these metals, the Institute has been able to develop synthetic semi-conductors from the plastic polyacryl nitril, a substance used in the production of synthetic fibres. Until now the rare metals have always been used for such products as radio transistors and rectifiers. The plastic semi-conductors are said to be more durable, more easily processed and cheaper than those from the metals of which there is a shortage in the Eastern European bloc.

MINING MISCELLANY

Representatives of the Crownest Pass Coal Co., Coleman Colliers and West Canadian Colliers, are visiting Japan this month to negotiate the sale of Canadian coking coal to the Japanese steel industry. The Canadian industry hopes to obtain contracts for this year and possibly next. The mines recently completed delivery of 110,000 tons of coking coal ordered by Japanese steel mills last winter. Future business will depend on the suitability of Canadian coal and on price, but reports so far are slated by a spokesman of the companies to be satisfactory.

A plan is jointly being worked out by the Israel Ministry of Development, and the Negev Phosphate Co., for the construction of a second phosphate plant at the site of Ein-Yahav, in the Negev, where phosphate reserves have been discovered. Preliminary research on the quality and quantity of these deposits, which cover a wide area, will cost about £40,000, and experiments are also being carried out into means of enriching the ore in the company's laboratories at Oran and in the U.S. Tests are also being made on new equipment at Oran to raise the percentage of phosphorus oxide in the phosphates from 28.5 to 31 per cent.

A General Mining Bill, placing all mineral resources in Indonesia under the control of the state, was presented by the government to parliament in Djakarta recently. Present private concessions, however, would still be valid so long as holders "adapt themselves within a definite period by fulfilling requirements as contained in the new law". Private companies may still exploit Indonesian mineral resources so long as the companies are of Indonesian nationality or the management entirely made up of Indonesian nationals. An Oil Bill, similar to the General Mining Bill, was presented at the same time.

A new company called Societe de Recherches et d'Exploitations des Bauxites du Congo (Bauxicongo), with a capital of 26,500,000 Frs. Congolese, has been formed to prospect for bauxite in the lower Congo, near the site of the projected hydroelectric power station at Inga. Concerns forming the new company are Forminiere, a Belgo-American company working diamond fields and in the Belgian Congo, and the Bamoco prospecting syndicate.

The Billiton Co., of The Hague, and the Albatross Sulphur Acid and Chemical Works of Utrecht, have reached agreement in principle to form a company for the manufacture in Holland of titanium pigment. Plans include the building of a factory in the Botlek area of the Port of Rotterdam, with an initial capacity of 10,000 tonnes of titanium dioxide per annum, which will entertain an investment of about Fl.30,000,000. Technical assistance will be supplied by the Glidden Co., of the U.S.

American Brass Co., wholly-owned subsidiary of Anaconda Co., plans to build a \$1,500,000 research centre in Waterbury, Conn. Work, to be started next summer, should be finished by 1961. The new centre will include metallurgical, corrosion and chemical laboratories, and equipment for experimental production of new products, as well as offices for the company's technical staff.

Mr. Robert P. Koenig, president of Cerro de Pasco Corporation, disclosed recently that the company has development plans for its big Rio Blanco copper mine in Chile, which call for construction of facilities that would turn out copper concentrates for about 68,500 tons of refined copper annually. Estimated cost of the project would be between \$70,000,000 and \$90,000,000, and negotiations for an agreement with Chilean Government must be completed before a decision to bring the mine into production could be made. Rio Blanco Copper Corporation's property, located about 35 miles north-east of Santiago is at present in the preliminary stage, and a partial drilling campaign has indicated reserves of at least 116,000,000 tons of ore averaging 1.6 per cent copper. Cerro is at present engaged in engineering studies to drive a 3½-mile development and access tunnel under the orebody to probe the ore at depth.

The world's first blast furnace to have a complete sillimanite stack lining—the Queen Mary of the Appleby-Frodingham Steel Co. (branch of the United Steel Companies)—was lit at Scunthorpe recently. The stack lining was supplied by General Refractories of Sheffield in Sillmax "I" quality, a bondless brick manufactured from 100 per cent natural sillimanite of highest purity.

An agreement, taking effect immediately, has been concluded between Kelvin Hughes and the Curtiss-Wright Corporation of America for the exclusive right to manufacture and sell the non-destructive testing equipment of the other partner, with full sales and service facilities. Kelvin Hughes will represent both interests in the U.K., the Commonwealth (except Canada) and Europe, and Curtiss-Wright in the U.S.A. and Northern America.

The Scottish Division of the National Coal Board has placed an order with Heyes and Co. of Wigan for a 3-level type 40 shaft signalling indicator system for installation at Arncliffe Colliery (Lothian Area). Similar equipment is already in service at several other N.C.B. collieries.

Atlas Copco have just merged their Northern and Southern Rhodesian companies into one concern under the title of Atlas Copco Rhodesia (Pvt.) Ltd. With an investment of over £250,000 already in the Federation, it is proposed to extend the company's activities into Nyasaland.

The chairman of Tableland Tin Dredging, Australia's largest tin producer, has stated that in his opinion without some form of government assistance, the industry will disappear. The company is operating a large bucket dredge at Mount Garnet, North Queensland. Costs are double those in Malaya. Conditions imposed by the Queensland Government subsequent to the granting of the leases require settlement of slimes and expenditure on this account, which in 1959 amounted to £A.35,000, or the cost of an 8 per cent dividend. While operations at Mount Garnet compare in efficiency with any part of the world, it would not pay under present conditions, in the chairman's opinion, to equip a tin mine in Australia unless it was a "bonanza". Unless aid is given, the Australian tin plate industry must depend on overseas supplies, which are gradually being exhausted.

Coal production in the six-nation European Coal and Steel Community during 1959 was hit by western Europe's continuing coal glut crisis. Output dropped to 234,880,000 tons in 1959, compared with 246,390,000 in 1958. Record coal production in the Community was achieved in 1956, with 249,100,000 tons.

It is reported from Yugoslavia that a contract has been concluded by the export enterprises "Jugomineral" of Zagreb and "Metaleksport" of Sarajevo, for the sale of 10,000 tonnes of lump barytes to the U.S.A. This brings the total of barytes sales for 1959 up to the record figure of 150,000 tonnes. It is estimated that this year exports should amount to about 100,000 tonnes, having a value of approximately \$1,500,000.

Mr. Henry A. Brimo, president of Baguio Gold Mining Co., in the Philippines, told stockholders that it was not proposed to declare a year-end dividend for 1959 because of sharply increased taxes and higher operating costs. While Baguio Gold Mining is the first mining company to make this announcement, it is widely believed that other companies will follow suit as a precautionary measure to conserve resources against rising expenses.

The French geologist, Henri Carrat, director of the French Atomic Energy Commissariat, who has been studying Argentine uranium deposits for some months, stated in Buenos Aires recently that those in Salta Province were "surprisingly great". He considered that the Salta deposits were well worth exploiting, although less well-known than those in the provinces of Cordoba and Mendoza.

It is reported that tin ores are now being produced at a site north of the Polar Circle, in north-eastern Siberia. Tin concentrates, produced at the site at Yultin, are then to be transported by road to the port of Evgekinot, where they are loaded into sea-going vessels for shipment to the tin refinery at Novo-Sibirsk. During 1958 the Soviet Union exported 22,300 tonnes of tin, and imported some 19,400 tonnes from Communist China.

Metals and Minerals

Consumption of Aluminium Rises

Aluminium Limited's sales in 1959 were in the region of 635,000 tons, being an increase of 10 per cent over the previous year, states the company's president, Mr. N. V. Davis, in a preliminary year-end report. These figures, it has been explained, represent consolidated sales to third parties of aluminium in all forms.

In the first nine months of the year sales by the company totalled 443,000 tons. Hence the figure given by Mr. Davis indicates that in the fourth quarter they amounted to 192,000 tons, an improvement which is indeed impressive. It is understood that the increase has for the most part been outside North America and chiefly in Britain and Europe.

Mr. Davis also announced that the production rate of the firm's Canadian smelters was being increased progressively over the next few months, an output of 675,000 tons in 1960, or approximately 87 per cent of the present rated capacity, being envisaged. It will be recalled that last month an increase to an annual rate of 595,000 tons was announced. In 1959 production from the company's Canadian plants totalled 520,000 tons.

Mr. Davis further stated that planned output at the Canadian smelters, together with output from overseas subsidiaries and contractual acquisitions from other sources, totalling some 100,000 tons in 1960, should permit the company to "fill present bookings as well as retain reasonable stocks against further possible increases in sales".

Commenting on the report, traders in Canada pointed out that the method of stating the rate to which the Canadian smelter production was being raised was not strictly comparable with previous announcements, since it projected total production for 1960 and not the annual rate expected to be achieved when the increase was completed. This annual rate was around 700,000 tons, or 90 per cent of capacity, it was understood.

*

Agreement on a new three-year contract between Alcoa and the United Auto Workers Union, covering 3,000 workers at four factories, has been announced by the company. Under the contract, workers at the four factories will get package increases of 28½ c. hourly over the three years. The contract is similar to others agreed to recently by the company and two other unions—the United Steelworkers Union and the Aluminium Workers International Union.

Alcoa has "no present plans" to go above the level of 26 c. to which some two weeks ago it restored the price of pig.

The settlement of the steel labour dispute has strengthened prospects for 1960 in the U.S. aluminium industry, which are regarded as very bright. According to *The Chemical Week*, a McGraw-Hill publication, part of aluminium's upsurge reflects the swing of

business activity in general, but producers emphasize that the metal is steadily wedging its way into new markets. One industry estimate reports the following sales gains in 1959: building products up 40 per cent; transportation uses up 35 per cent, and packaging up 50 per cent. The industry expects to continue making inroads into the automotive, can and packaging markets.

Another reason for confidence is the belief that imports of semi-fabricated products from Europe may be easing. While Europe's aluminium output is rising, so, too, is its consumption. Already shipments of scrap to the U.S. have all but stopped, and now U.S. secondary aluminium producers are complaining that they cannot get enough scrap to keep plants in full operation. According to the magazine, there is plenty of room in Europe for aluminium consumption to grow and take the pressure off the U.S. market.

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The Bell aluminium plant in Tasmania is negotiating for a regular supply of bauxite from India, reports the company's general manager, Mr. A. L. Ellis, who stated that an experimental shipment of 9,000 tons of Indian bauxite had been processed and found "entirely satisfactory". A representative of the firm is on his way to India to negotiate for supplies to supplement shipments from Indonesia and the Philippines.

*

U.S. domestic output of bauxite in 1959 was estimated at 1,500,000 tons, being an increase of 14 per cent in comparison with 1958 production. Imports of bauxite, at approximately 8,000,000 tons, represented a slight increase over 1958. Jamaica supplied an estimated 50 per cent, Surinam 40 per cent, Dominican Republic 5 per cent, and Haiti and British Guiana supplied the remaining 5 per cent. U.S. production accounted for about 16 per cent of the total new supply, as compared with 14 per cent in 1958. Consumption of bauxite increased by 14 per cent over the 1958 total to an estimated 8,000,000 tons.

*

The U.S. Navy's latest attack-bomber, the A3J Vigilante, is the first aircraft to have its skin of a unique lithium-aluminium alloy developed by Alcoa. Over 4,200 lb. of this alloy is being used by North American Aviation, Inc., to provide the Vigilante with strength and weight-saving advantages not possible with standard aluminium aircraft alloys. Besides offering a 3 per cent weight saving over conventional aluminium alloys, the new material maintains high strength up to 400 deg. F.

INDIAN CHROMITE EXPORTS

The Joint Chief Controller of Imports and Exports has announced in Bombay that chrome ore will be licensed freely for export from India during 1960.

LITHIUM DISPUTE SETTLED

The Lithium Corporation of America has announced a compromise settlement of the suit brought against it by Quebec Lithium Corporation, under which Lithium Corporation will pay \$1,900,000 to Quebec Lithium over a four-year period. Quebec Lithium in September brought a suit for \$4,000,000 against Lithium Corporation, after the latter had written to Quebec Lithium terminating its long-term contract for the purchase of lithium ore. Officials of Lithium Corporation estimate that the total out-of-pocket costs of the settlement to their company will be less than \$800,000.

BERYLLIUM RESEARCH AGREEMENT

A subsidiary of Tube Investments, the Chesterfield Tube Co., has reached an agreement with the Superior Tube Co. of Norristown, U.S.A., on techniques of beryllium tube manufacture, whereby the U.S. company is to be supplied with details of techniques of beryllium tube drawing and finishing developed by Chesterfield Tube and T.I. Research and Development Division. It is claimed that the British company leads the world in beryllium precision tube manufacture.

U.S. SULPHUR RECORDS

Shipments of U.S. sulphur abroad increased for the second consecutive year and virtually equalled the record tonnage exported in 1956. In his review of 1959 Mr. Langbourne M. Williams, chairman of Freeport Sulphur Co., said that according to preliminary data, exports exceeded 1,600,000 tons, while final figures might show the total to be higher than the 1,651,000 tons shipped four years ago.

U.S. consumption of sulphur in all forms was estimated at 6,000,000 tons, being an increase of more than 10 per cent over 1958. The previous record of 5,800,000 tons was established in 1956. This gain is attributed to the pick-up of business by major consuming industries such as fertilizer, chemicals, paper, pigments and rayon.

Domestic sulphur production in the U.S. rose to an estimated total, from all sources, of 6,225,000 tons from 6,140,000 tons in 1958. Most of the increased demand was met from stockpiles of producers, who cut back stocks from 4,000,000 tons to about 3,400,000 tons.

Imports of sulphur, although at a high level, failed to maintain the sharply rising trend begun in 1955 with the development of Frasch-process mines in Mexico. However, they almost equalled the 755,000 tons imported in 1958.

SILICON PLANT PROJECT

In order to handle its increasing production of silicon aluminium alloys for the foundry industry, Reynolds Metals plans to build a silicon plant at its Listerhill reduction works, Sheffield, Alabama. The projected facility is the first silicon plant to be built by Reynolds and will have a capacity of about 5,000 tons of silicon metal per year. Construction is expected to begin about the middle of 1960. Silicon metal is added to aluminium to increase hardness and castability.

COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

The week under review has been very quiet with a steady undertone which continued throughout apart from a short period when the weakness of Wall Street and on the London Stock Market caused some uncertainty.

U.S. COPPER BUYERS WAIT AND SEE

The copper market has remained relatively steady with the general trend still being upwards and with a tendency for the backwardation to increase again. Demand has been satisfactory during the week except that in the U.S. the settlement of the steel strike did not lead to the demand for copper which was expected. However, this may be explained by the very small tonnage of metal which is available and the general desire to prevent prices from going higher. In the U.K. it was announced that China's National Metals Import Corporation had placed an order with five British companies for copper rods worth £8,000,000 (incorrectly reported here last week as £18,000,000).

Stocks in the U.K. showed very little change, being 50 tons lower at 5,322 tons. Provisional figures for the 1959

output of copper from the three large mines in Chile show that the half-million mark was almost reached with 498,247 tonnes and it must be remembered that about one month's production was lost at El Teniente through a strike in October.

In the U.S. the situation remains unchanged with no further strike settlements having been announced and with dealer copper at a little over 37 c. per lb. for January, the customs smelters at 35 c. per lb. for March and the producers' at 33 c. per lb. where they have any copper to sell. The amount of metal available is probably insufficient for consumption but, as mentioned above, buyers are holding off in the hopes of avoiding forcing the price up again to the 39 c. figure which was reached before the turn of the year.

TIN "BACK" UNCHANGED ON WEEK

Apart from one extremely active day, the tin market has been featureless with the backwardation being maintained at £3-£4 per ton. The day of maximum activity, when the morning turnover reached 865 tons, followed a day on

which the backwardation had been increased to about £8 per ton owing to demand for cash metal, and dealers wondered whether the buffer stock manager was taking action to control the backwardation, but it is by no means certain that this was the case. Whatever the reason, however, the recent pattern of prices has been re-established.

Stocks in official warehouses showed a slight rise of 28 tons to a total of 8,721 tons. The daily turnover in the East remains above the 200 ton mark and with commercial demand remaining reasonable in Europe and picking up in the U.S., it is felt that some time can elapse before the additional offerings commence to weigh on the market.

On Thursday the Eastern price was equivalent to £792½ per ton c.i.f. Europe.

LEAD AND ZINC FIRM

The lead and zinc markets have remained firm with demand for forward zinc causing the backwardation in that metal to decrease. Lead consumption remains satisfactory and it is generally expected that prices will continue to strengthen. The firm zinc market has resulted in a rise in the U.S. East St. Louis price to 13 c. per lb. and some producers have used the opportunity of the altered price to increase the premium for both the higher grades of zinc to 1½ c. per lb. as opposed to the 1½ c. per lb. which ruled previously.

The strength of the market in the U.S. was underlined by the American Zinc Institute's figures for December, which showed that during that month stocks dropped by 20,000 s.tons at 154,419 s.tons which is the lowest figure for more than two years. Production rose some 6,000 tons at 69,666 s.tons, whilst total shipments showed a jump of 14,000 tons to 91,404 s.tons. The Institute also indicated that for 1959 the U.S. zinc output was 858,020 s.tons against 828,902 s.tons in 1958, whilst total shipments were 893,838 s.tons against only 805,325 the previous year.

In Europe, where unsold supplies of both prompt lead and zinc are scarce, demand is being maintained at a high rate and the shortage is expected to continue. The O.E.E.C. production of pig lead during November amounted to 61,097 tonnes which was slightly higher than the October figure. The zinc production amounted to 71,463 tonnes as compared with 74,198 tonnes for October.

Closing prices are as follows:

	Jan. 7		Jan. 14	
	Buyers	Sellers	Buyers	Sellers
COPPER				
Cash	£253½	£254	£255½	£256½
Three months ..	£243½	£243½	£245	£245½
Settlement ..	£254		£256½	
Week's turnover	9,650 tons		9,175 tons	
LEAD				
Current ½ month ..	£74½	£74½	£74½	£75
Three months ..	£73½	£74	£74½	£74½
Week's turnover	6,950 tons		6,600 tons	
TIN				
Cash	£793½	£794	£790½	£791
Three months ..	£785	£785½	£787	£788
Settlement ..	£794		£791	
Week's turnover	705 tons		1,600 tons	
ZINC				
Current ½ month ..	£95½	£95½	£94½	£95
Three months ..	£90½	£90½	£92	£92½
Week's turnover	5,500 tons		9,925 tons	

LONDON METAL AND ORE PRICES, JAN. 14, 1960

METAL PRICES

Aluminium, 99.5%, £180/£186 per ton
Antimony ..
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 0d. lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 8½d.
Iridium, £23/£25 oz. nom.
Lanthanum (98%/99%) 15s. per gram.

Manganese Metal (96%/98%) £245/£250
Magnesium, 2s. 2½d./2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £21/£23 oz. nom.
Osmiridium, nom.
Palladium, £8 12s. 6d.
Platinum U.K. and Empire Refined £28 10s. oz.
Imported £27/£27½
Quicksilver, £71½/£72 ex-warehouse
Rhodium, £41/£45 oz.
Ruthenium, £18/£20 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 80½d. f. oz. spot and 79½d. f'd
Tellurium, 21s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis 20s. 0d./22s. 0d. per unit, c.i.f.
Beryl (min. 10 per cent BeO) 250s. per l. ton unit BeO
Bismuth 30% 5s. 0d. lb. c.i.f.
20% 3s. 3d. lb. c.i.f.
Chrome Ore—
Rhodesian Metallurgical (semifriable 48% (Ratio 3:1) £15 15s. 0d. per ton c.i.f.
" Hard Lumpy 45% (Ratio 3:1) £15 10s. 0d. per ton c.i.f.
" Refractory 40% £11 0s. 0d. per ton c.i.f.
" Smalls 44% (Ratio 3:1) £14 0s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3:1) £11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10:1).
Nb₂O₅.Ta₂O₅ 175s. per l. ton unit c.i.f.
Fluorspar—
Acid Grade, Flotated Material £22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF₂) 156s. 0d. ex. works
Lithium Ore—
Petalite min. 3½% Li₂O 40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li₂O 40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li₂O £25 0s. per ton f.o.b. Beira
Magnesite, ground calcined £28 0s./£30 0s. d/d
Magnesite Raw (ground) £21 0s./£23 0s. d/d
Manganese Ore Indian—
Europe (46%-48%) basis 6s. 6d. freight 73d./75d. c.i.f. nom.
Manganese Ore (43%-45%) 69d./71d. c.i.f. nom.
Manganese Ore (38%-40%) nom.
Molybdenite (85%) basis 8s. 11d. per lb. (f.o.b.)
Titanium Ore—
Rutile 95/97% TiO₂ (prompt delivery) £29 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO₂ £11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%) 152s. 0d./155s. 0d. per unit c.i.f.
Vanadium—
Fused oxide 95% V₂O₅ 8s./8s. 11d. per lb. V₂O₅ c.i.f.
Zircon Sand (Australian) 65-66% ZrO₂ £16/£16 10s. ton c.i.f.

Mining Finance

Boreholes in the News Again

The success of the post-war gold fields in South Africa means that the mining finance houses have capital funds that are burning holes in their pockets. It is thus not surprising that a widespread and intensive search for still further gold fields to conquer has been in progress for some time past now.

One of the more obvious areas for a programme of re-drilling is the ground that lies on the southern side of the Vaal river, immediately to the south of the Klerksdorp area field. The river, of course, presents no geological barrier, but when this ground was first drilled it did not yield sufficiently good results to warrant its exploitation at a time when the Orange Free State field over 50 miles to the south was giving such exciting values. The O.F.S. obviously had to be the target for financial resources which were relatively limited at that time. The Western Holdings company in particular had no urge to go ahead with the exploitation of its ground to the south of the Vaal river when it had a property on the boundary of which a 23,000 inch-dwt. borehole strike had been made.

Now, with its own property established as a highly prosperous producing mine, the company is having another look at its

Vaal river ground. Details of some of the new drilling were given in the recent annual report. They were not particularly exciting. The December quarterly, however, shows that a drill on one of these farms, Chrystalkop 693, has brought up a core from a depth of 7,227 ft. with an average gold content of 20.3 dwts. a ton over a width of 62.5 inches, which is equal to 1,269 inch-dwts. The core recovery was complete. The depth, of course, is considerable. From the other drilling it looks as though the dip of the reef is from west to east as it is in the Vaal Reefs mine immediately to the north. The shallowest intersection to date is in the north-western part of Pretoriuskraal 53 where a value of 303 inch-dwts. was yielded at a depth of 4,378 ft.

On the eastern boundary of the Western Holdings ground, as recently announced, a joint borehole (b.z.1) with Free State Development has been stopped in footwall measures at 7,562 ft. without cutting the Vaal reef which was displaced by a fault. Deflections of this drill are now being made. It looks as though faulting and depth may be one of the chief handicaps in any attempt that may eventually be made to open up a new mine or mines in this area.

From the share market viewpoint there is

no doubt that an exciting new speculative string has now been added to Western Holdings' golden bow. Union Corporation, too, is a major participant in this region south of the river. It has done considerable drilling, but has obviously decided, for the moment anyway, that its new Far Eastern Rand gold field is a more promising proposition and is accordingly concentrating its efforts there.

RICH VALUES AT HARTEBEEST

It was not the Western Holdings news that made most impact on the share market. Holdings had, in fact, already had a major rise in front of the news, reaching a peak 187s. 6d. compared with a Christmas Eve price of only 161s. 3d. The really dramatic announcement came as a bolt from the blue from the Hartebestfontein mine some three miles further north. This company, already a well-established gold and uranium producer, has been drilling in its deeper areas in the western part of the property where a new shaft, No. 4, is just being started. Now one of the drills, HB23, has brought up a not quite complete core with the phenomenal gold content of 358.72 dwts. per ton over a corrected width of 42.7 inches equal to the huge inch-dwt. figure of 15,317. The depth of the Vaal reef was 6,125 ft. It was no wonder that the shares straight away shot up over 8s. to 65s. if only because below average value development results have so far been obtained from the eastern part of the deep-

LONDON MARKET HIGHLIGHTS

If it had not been for the news of the 15,317 inch-dwt. borehole at Hartebestfontein, the South African gold share market would have been very subdued indeed. As it was, the Hartebest result—a very well-kept secret—sent the company's shares rocketing 10s. to 66s. 3d. on the day of the announcement (they closed at 64s. 4½d.) and lifted those of the neighbouring Zandpan 2s. 3d. to 21s. Other companies with interests in Hartebest responded to the move: New Pioneer jumped 2s. 3d. to 41s. 6d., while Eastern Rand Extensions (28s. 9d.) and West Rand Investment (76s. 6d.) both moved up 1s. 9d.

Meanwhile, Western Reefs were enjoying a boomlet of their own, rising 2s. 6d. to 33s. 9d. on the news contained in the quarterly of a sharp rise in both tonnage and gold grade in their reserve. On the other hand, although Loraine's development values in the T.V.2 borehole area were considered to be very encouraging they failed to reach the most optimistic expectations, and the shares eased back to 37s. 3d. Welkom (23s. 3d.) were also lower despite a further improvement in gold values while Free State Saaiplaas shaded to 20s. in front of rather disappointing results in the quarterly report. Western Holdings encountered profit-taking at 185s. 7½d. after the sharp rise on Monday to 187s. 6d. which had followed their high value borehole strike in the Klerksdorp area property to the south of Vaal Reefs.

All this happened on Tuesday. On the following day the market relapsed into the quiet atmosphere in which it had started the week. The inevitable profit-taking was easily absorbed, however, Hartebest losing only 7½d. of the previous day's net rise and the parent Anglo-Transvaal actually gaining 9d. more to 55s. 6d. Most other prices

lost a few pence with West Driefontein falling 1s. 3d. to 200s. St. Helena eased to 77s. 6d. in front of the fall in reef values detailed in the mine's quarterly report and in the diamond group persistent selling from the Continent lowered De Beers to 188s. 1½d.

Dullness on Wall Street coupled with uncertainty in the industrial market sections resulted in a setback for copper shares. But the market soon steadied up, being assisted to do so by a remarkably firm metal price.

Tins also had a temporary attack of uneasiness. Its cause was traced to reports that some brokers in Singapore were demanding a 25 per cent cash deposit from buyers there of overseas shares pending ultimate delivery of the scrip. It was thought that this local rule, designed to curb overspeculation in the East, might have an adverse effect on business here. Whether it will do so or not remains to be seen, but the tin share market soon recovered its aplomb and was helped in this by some encouraging dividends, notably those of Tronoh and Idris.

In the West African gold group, the generally satisfactory results from Ashanti actually lowered the shares 7½d. to 24s. 4½d.; it seemed that some holders had been hoping that there would have been a bonus payment in addition to the forecast dividend. News of the Ghana Government's £450,000 loan to Amalgamated Banket was welcomed and it was thought that these shares should now start to move up from their present price of 1s. 10½d. But they would have to go some to equal the performance of Oceana Consolidated which nearly doubled in price to 2s. 4½d., on rather vague hopes that the company might have "shell" possibilities.

JOURNALIST FOR GROUP MAGAZINE

The Rhodesian Selection Trust Group of Companies requires a journalist to work in the Northern Rhodesian Copperbelt on a monthly magazine published by the Group. Applicants should have had at least five years' practical experience in magazine or newspaper journalism. Reporting experience essential; sub-editorial experience and knowledge of the mining industry an advantage. The post involves travelling throughout the Copperbelt by car which will be provided.

Starting basic salary will be not less than £1,320 per annum, plus variable cost-of-living allowance at present approximately £67 per annum. The successful applicant will also participate in a variable bonus scheme currently paying 33 per cent of basic salary, and in a pension and life assurance scheme. There is also a medical scheme and a share purchase plan.

Paid leave is at the rate of 48 days a year which may be accumulated over three years' service. In addition, five days' casual leave are allowed annually.

Single or married accommodation with basic furniture or an allowance in lieu, is available at a nominal rental.

Applications enclosing, if possible, specimens of published feature articles should be made in writing to:

The Public Relations Officer,
P.O. Box 1479,
Salisbury,
Southern Rhodesia.

level section which is being opened up from the Nos. 2 and 3 shafts. This has been a factor in depressing the share price in recent times, the other factor being the dividend cut enforced by the heavy capital expenditure programme.

It would be as well to bear in mind in connection with the latest borehole result that other cores, which were complete, brought up in deflections of the same drill gave the more modest values of 602 inch-dwts. and 714 inch-dwts. These, however, are still good compared with the average pay values of 380 inch-dwts. from the Nos. 2 and 3 shafts last quarter. The HB23 results should at least make for more confidence in the long-term future of Hartebeest. They render quite attractive the good yield obtainable on the shares on the basis of the reduced 6s. per annum dividend rate.

ASHANTI TRUE TO FORM

Ashanti Goldfields is paying a final dividend of 1s. on the 4s. shares making 2s. for the year to September 30 last. This is as forecast by the chairman, Major-General Sir Edward L. Spears, last April following the announcement of the latest scrip issue which was one for three and was effected at the end of April. It means that on the present capital shareholders are receiving in all £764,740 after tax against £673,050 in the previous year when distributions totalled 2s. 6d. a share on the old capital. The 1958-59 payment is well covered by the net profit which comes out at £976,180 (against £769,214) after tax of £584,810 which owing to the Overseas Trade Corporation concessions is now mostly incurred in Ghana. Fixed assets replacement reserve again gets £100,000; the allocation to prospecting reserve is stepped up by £5,000 to £75,000 and the carry forward from £535,800 to £572,240.

In the first three months of the current financial year Ashanti's gross working profit at £445,488 compares with £391,621 for the same period of 1958. So, despite the continuance of sizable capital expenditure requirements, the 2s. dividend looks like being the least that can be expected in this

and future years. The full report is expected on March 7 and the annual meeting on March 30. The latter is usually particularly informative.

AMAL. BANKET GETS LOAN

More news concerning Ghana gold-mining was announced on Wednesday by Mr. C. J. Burns, chairman of the Western Selection group of producers. He revealed that Amalgamated Banket Areas has been able to follow Bremang's example in obtaining an interest-free loan from the Ghana Government. It amounts to £150,000 per annum for three years starting on October 1 last, making £450,000 in all. The second and third years' instalments are dependent on the Government being satisfied that financial assistance on this sort of scale is still needed. The agreement does not preclude the company from paying a dividend (its last distribution on the 3s. stock units was 10 per cent for 1954-55), but if it wishes to pay 3 per cent or more in any one year then it must first repay 12½ per cent of the sum owing to the Government.

Mr. Burns said the loan would mean that A.B.A. would now be spending on development the largest amount per annum of any of the Ghana gold mines. This would open up the prospect during the next three years of greatly increased ore reserves and the examination of unexplored parts of the large lease area. Mr. Burns's news certainly represents further important evidence of the commonsense manner in which the present Ghana Government is treating the mining industry. It should do the market in Amalgamated Banket units no harm. They are currently 1s. 10½d. But what the company really needs to transform its earnings prospects is a rise in the gold price.

BRITISH TIN PAYS 22 PER CENT

British Tin Investment Corporation naturally still tends to be regarded primarily as a tin share investment concern. Actually, it has in recent years spread its wings quite

considerably beyond this metal, although some two-thirds of its holdings, taking market value, are still in tin. It also has stakes in copper, oil, lead-zinc and in various Canadian companies. Thus in 1959, a year when things began to look better for copper and tin producers in particular, B.T.I. has been able to arrest the downward trend of its earnings. Consolidated net revenue comes out at £276,055 against £266,207 in 1958 after tax of £227,058 against £259,073. Adding provisions no longer required and tax adjustments the available total is £294,444.

The final dividend on the 10s. shares is 16 per cent making 22 per cent for the year. This requires a net pay out of £283,660. The up-to-the-hilt distribution is in line with the company's past policy, but is no doubt also encouraged on the present occasion by the prospect of better things to come in 1960 when tin dividends should be rising strongly as a result of the rapid loosening of the output restriction screw. B.T.I. stand at 28s. 6d. to yield 8 per cent after allowing for the final dividend in the price. This looks an attractive return for a company of this calibre especially in these days when the general run of yields tends to be so meagre.

News from Alaska.—A report from Salisbury states that work has begun on the new £750,000 Messina smelting and refining plant at Alaska. A Messina spokesman said that work was going according to plan, and smelting should commence in October next. Concentrates from Mangula, as well as from the new Alaska mine will be treated.

Taquah and Abosso.—A general meeting of Taquah and Abosso Mines (in voluntary liquidation) will be held on January 29.

BURMA CORPORATION (1951) LIMITED

which operates a large Silver/Lead/Zinc Mine in the Northern Shan State. BURMA, invites applications for the position of

CHIEF METALLURGICAL ENGINEER

to take charge of the Company's Smelting and Refining operations.

Applicant should be a fully qualified graduate of a reputable School of Mines preferably with a minimum of 10 years' practical experience in the metal extraction processes associated with Silver/Lead/Zinc ores.

Salary, with allowances, would total Ksats 2,575 per month (equivalent to £193 2s. 6d. Sterling) plus free housing, light, fuel and medical attention and partly furnished living quarters, participation in Company's Provident Fund and Retirement Gratuity Scheme.

Four years contract with 6 months paid leave on completion.

Free passages each way for self, wife and two children.

Advise, not later than end February, 1960. Write fullest details education, qualifications, experience, age and family status to Box. L.402. W.P.S., Thavies Inn House, Holborn Circus, London, E.C.1.

ASHANTI GOLDFIELDS CORPORATION LIMITED

Notice is hereby given that the Board of Directors have today recommended a Final Dividend (No. 126) on the Issued Capital of the Corporation at the rate of 1s. per Share, less Income Tax at 7s. 9d. in the £. This Dividend which is in respect of the year ended September 30, 1959, is to be payable on and after March 31, 1960, to all Shareholders on the Registers on February 5, 1960.

The TRANSFER BOOKS WILL BE CLOSED from February 6, 1960, to February 15, 1960, both dates inclusive, for the preparation of Dividend Lists.

By Order of the Board.
E. W. MORGAN, Secretary.

Registered Address:
10 Old Jewry, London, E.C.2.
January 12, 1960.

BIBIANI (1957) LIMITED

Notice is hereby given that the Board of Directors have today recommended a Final Dividend (No. 42) on the Issued Capital of the Company at the rate of 2.4d. per share, less Income Tax at 7s. 9d. in the £. This Dividend which is in respect of the year ended September 30, 1959, is to be payable on and after March 31, 1960, to all Shareholders on the Registers on February 5, 1960.

The TRANSFER BOOKS WILL BE CLOSED from February 6, 1960, to February 15, 1960, both dates inclusive, for the preparation of Dividend Lists.

By Order of the Board.
E. W. MORGAN, Secretary.

Registered Address:
10 Old Jewry, London, E.C.2.
January 12, 1960.

ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED

GOLD MINING COMPANIES IN THE ORANGE FREE STATE

(All companies mentioned are incorporated in the Union of South Africa)

Extracts from the Statements by Mr. S. SPIRO, Chairman of the O.F.S. Gold Mining Companies

issued with the Annual Reports for the year ended September 30, 1959

PRESIDENT STEYN GOLD MINING COMPANY LIMITED

THE increase in the supply of Native labour made it possible to operate both shafts at near-full capacity. The total tonnage milled was increased by 46,500 to 1,190,500 tons and surface sorting was improved to a satisfactory level of 15 per cent. compared with the rate of 11.9 per cent. in the previous year.

The larger tonnage milled and the improvement of 0.14 dwt per ton in the average grade of gold recovery, resulted in an increase of £316,627 in the total revenue of £5,797,358 from the production of gold. Average working costs have increased by 3s. 9d. to 58s. 4d. per ton milled, owing partly to rises in the cost of essential services and stores and partly to intensified surface sorting. In addition, an illegal strike of three days during December, 1958, caused a decline of 12,500 tons in the ore milled and reduced the working profit for that month by approximately £50,000. The overall effect was the fall in the profit from gold of £34,240 to £2,326,292. Uranium profits were slightly higher and the company's total profit from gold and uranium sales, at £2,959,134, was £10,896 less than in the preceding year.

Unchanged dividends totalling 2s. 6d. per share for the year absorbed £1,750,000. It was unnecessary to provide for either taxation or lease payments; the assessed loss as at September 30, 1959, was estimated at £7,414,000.

The net expenditure during the year on fixed assets amounted to £1,285,222, after taking into account the company's contribution of £104,413 towards the amortization of the Welkom uranium plant, and contributions, amounting to £313,141, received from participants in the joint uranium production scheme towards the capital cost of the uranium plant on this company's property.

At September 30, 1958, the capital raised, which included the loan of £2,000,000 from Anglo American Corporation and the loan of £500,000 from the National Finance Corporation, exceeded expenditure on fixed assets at that date by £1,500,000. The loan from the National Finance Corporation was repaid in December, 1958, and has since been replaced by a further loan of £500,000 from that source on September 30, 1959. This loan is repayable not later than five years after the date of drawing. Payments in reduction of the uranium loans totalled £375,395, leaving a balance of £2,711,274 owing at the year end. After taking into account

these loan transactions and the appropriation from profits of £960,649 for the financing of capital expenditure, the funds provided at September 30, 1959, exceeded expenditure on fixed assets to that date by £800,000; this amount will be available towards meeting the company's capital requirements which are estimated at £3,000,000 for the current year. The present intention is that capital expenditure in excess of funds already provided will be financed from profits.

Work preparatory to the sinking of the No. 3 Shaft system was carried out as expeditiously as possible. Full-scale sinking operations commenced in the main hoisting shaft in mid-October, 1959, and it is anticipated that the sinking of the ventilation shaft will commence towards the end of 1959. Precementation has been carried out in four boreholes, two at each shaft site, to minimize the possibility of delays in sinking, that may arise out of occurrences of water-bearing fissures. The precementation boreholes drilled from the surface at the site of the No. 3 Main Shaft intersected the Basal Reef at approximately 4,600 feet and the assay results were 614 and 347 inch-dwt respectively.

World Shaft Sinking Record

A new world shaft-sinking record was achieved when the No. 3 Main Shaft was sunk a depth of 1,001 feet during the month of November, 1959. The impressive progress made in shaft-sinking techniques is illustrated by comparing this record with the best month's rate of sinking of 228 feet at this company's No. 1 Shaft, sunk over the period May, 1949, to January, 1952. This progress has been made possible by the use of improved mechanical devices and by precementation in advance of sinking.

The ventilation shaft will be sunk to a final depth of 6,000 feet. The main hoisting shaft will be sunk to a depth of 6,300 feet and, while sinking operations are in progress, development will be undertaken in the vicinity of the new shaft on 40, 44 and 48 Levels advanced from the No. 2 Shaft. This work will include the cutting of ore and waste pass systems and the provision of stope faces in the area of the No. 3 Shaft system. Once the hoisting shaft is brought into commission to its final depth, temporary loading arrangements will be made on 50 Level to enable both development and stoping operations to be started on the aforementioned levels. Simultaneously, development will be under-

taken below 50 Level to complete the ore pass systems and the final loading arrangements at the shaft bottom. By adopting this procedure, it will be possible to derive the benefit of mining in the area served by No. 3 Shaft system at the earliest opportunity. During the year, a total of 70,003 feet was developed—13,835 feet were sampled of which 80.16 per cent proved payable at an average value of 483 inch-dwt as compared with a percentage payability of 73.6 and value of 467 inch-dwt in the previous year. In the area served by No. 1 Shaft, development was undertaken on all levels to the north and south, and here the payable values averaging 409 inch-dwt were normal for this portion of the mine. A higher average payable value of 559 inch-dwt was revealed by development at No. 2 Shaft. This work was carried out mainly on the 40, 44 and 48 Levels in the vicinity of borehole KP 9 and in the general direction of the No. 3 Shaft system.

Ore reserves at the year-end totalled 4,869,000 tons, a substantial increase of 525,000 in the tonnage. There was a small drop in the stope value to 8.29 dwt per ton.

For some time, progress on the ventilation crosscuts on 27 Level, which were being driven towards Welkom No. 3 Joint Ventilation Shaft, was hampered by the intersection of water-bearing fissures in badly fractured ground associated with the Arrarat Fault system. It became apparent that considerable difficulty would be experienced in traversing the remainder of the ground to be covered and that the ventilation of the upper levels to the north and west of No. 1 Shaft could more readily be obtained from the new President Brand No. 3 Shaft system. In terms of an agreement, President Brand will take over this company's share in Welkom No. 3 Ventilation Shaft and in return will provide this company with an equivalent share in the ventilation capacity of its No. 3 Shaft system. The crosscuts on 27 Level were accordingly turned in a south-westerly direction and by November 30, 1959, had penetrated a distance of 1,160 feet into the President Brand property.

The overall improvement in the ventilation throughout the mine will make it possible to explore the deeper levels to the east of both Nos. 1 and 2 Shafts from sub-inclines at these shafts. During the year, good progress was made in the incline shaft being sunk

from 42 Level at No. 1 Shaft. It is not anticipated that work will start on the sub-incline at No. 2 Shaft until late in the current year.

Since the end of the financial year, the Transvaal and Orange Free State Chamber of Mines, representing the uranium producing companies, has agreed to participate with the Union Government

and certain industrial concerns in the financing of the programme of atomic research to be carried out by the Atomic Energy Board.

This programme is estimated to cost £4,000,000 over a period of five years, and the Chamber has agreed that £400,000 per annum will be contributed for five years by uranium producing

companies on the basis of the amount of uranium sold by each producer. The initial contribution by this company was the sum of £6,222 which was paid on October 14, 1959, and represented the company's proportion of the sum of £27,410 paid by the Orange Free State Joint Production Scheme for the period April 1, 1959, to December 31, 1959.

WELKOM GOLD MINING COMPANY LIMITED

DURING the year, substantial footages were developed in the No. 3 Shaft area and essential work was undertaken elsewhere to open up new sections of the mine with a view to expanding mining operations in the future. No. 1 Shaft was completed to its final depth and good progress was made in the deepening of No. 2 Shaft. Further ventilation connections were effected between existing workings and No. 1 vertical winze and primary development was undertaken from No. 3 Shaft. The company will now be better able to utilize the increased Native labour available to it in the mining of both newly opened areas and area freed from methane. I am confident that this will lead to a further increase in mill tonnage and improvements in recovery grade and consequently in revenue.

Working Profit Improves

An improvement in the gold recovery grade from 5.95 dwt to 6.13 dwt per ton, together with an increase from 1,026,500 to 1,149,000 in the tons milled, resulted in the working profit from gold production rising to £968,328, compared with £870,341 in the previous year. Profits from uranium production at £593,678 showed a small increase. The total profit for the year, therefore, is £1,562,006.

Dividends totalling 6d. per share were declared during the year and an amount of £306,250, equivalent to the dividends declared, was appropriated from profits towards the redemption of the company's five per cent. unsecured registered debentures in terms of their conditions of issue. At September 30, 1959, debentures of a nominal value of £714,769 remained to be redeemed out of future profits.

The balance owing by the company at September 30, 1959, on the uranium loans was £2,816,254, payments of £510,581, comprising redemption and interest, having been made during the year under review.

After taking into account the contribution of £88,688 made by the company towards the amortization of the uranium project on the President Steyn property and the contributions totalling £336,948 received from participants in the joint uranium production scheme towards the amortization of this company's uranium plant, the net expenditure during the year on fixed assets amounted to £542,980. It is estimated that approximately £600,000 will be expended in the current financial year on capital account. The major portion of the company's capital expenditure development programme has been completed, except for the deepening of the No. 2 Shaft. When this shaft has been sunk to its final depth and equipped, the

expenditure on capital account should be progressively smaller.

At September 30, 1959, the assessed loss for purposes of taxation was estimated at £14,577,000. Until such time as the aggregate of the assessed loss and any further redeemable capital expenditure incurred by the company has been exceeded by profits, the company will not become liable to taxation.

The ore reserve at the end of the financial year showed an increase in both tonnage and value and a small decrease in stope width. Compared with the previous year, the tonnage increased by 364,700 to 3,996,700 tons and the value by 0.17 dwt to 7.27 dwt per ton. The stope width decreased by 1.13 inches. The upward trend in the value of the ore reserve was maintained despite the drop in payable development values from 456 inch-dwt in 1958 to 403 inch-dwt. This decline in values was primarily due to development being restricted, on account of the incidence of methane, to a limited number of ends where the values encountered were below the average for the previous year.

The haulages north of the No. 1 Shaft encountered a fault which displaced the reef laterally by approximately 1,000 feet. Progress on the crosscuts being driven in an easterly direction to locate the reef was hampered by the intersection of water-bearing fissures. Towards the close of the financial year, the ends on 30 and 32 Levels passed through this zone and intersected the reef disclosing average payable values of 340 inch-dwt. However, little progress was made on 35 Level which was still in the fault zone. The bringing into operation of the fans at the No. 1 ventilation winze made it possible to deal with the methane in the upper levels to the west of No. 1 Shaft and a certain amount of development work was recommenced on these levels.

South-east of No. 2 Shaft, development on 35 and 32 Levels beyond the sill area disclosed values well below the average for the mine. Development footage driven in the sill area itself on 25, 27 and 30 Levels and on the duplicate levels to the south-west of the shaft, on sampling, disclosed satisfactory values, however.

At No. 3 Shaft, development was undertaken on 40 and 42 Levels. The major proportion of this development was in the disturbed zone associated with the Arrarat Fault system. Sampling of the reef disclosed values and percentage payability higher than the average for the remainder of the mine. Exploratory headings are being driven in a westerly direction on 40 Level to obtain more information about the potentiality of the area west of No. 3 Shaft. It is expected

that stope tonnage will be drawn from the No. 3 Shaft area during the latter half of the current financial year.

The development programme now being undertaken will be facilitated by the deepening of the Nos. 1 and 2 Shafts and the consequent extension of mining operations on the lower levels to the east of these shafts. Further development will also be possible on the upper levels west of these shafts as additional ventilation connections are effected between existing workings and both the No. 1 ventilation winze and the No. 3 Shaft system.

Loan Facilities Extended

An agreement has been reached with the Anglo American Corporation providing for the extension of the existing loan facilities of £2,500,000 for a further period of four years to December 30, 1963. Interest will be charged at a rate of 6½ per cent per annum on amounts drawn. It is hoped that this arrangement will enable the company to avoid raising additional permanent capital and to meet out of profits not only the contemplated expansion of mining operations and capital expenditure programme, but also the redemption of the balance of its debentures and the repayment of its other loans. On the other hand, should circumstances make it necessary to raise additional capital, the company will have been given greater flexibility and latitude to decide when, and in what manner, such capital should be raised.

Anglo American Corporation has been given the right to subscribe, on the same terms and conditions as may be offered to others, for up to 25 per cent of any issue which may be made by the company during the period of the loan. The corporation will have the right to underwrite any such issue for a cash consideration of 2½ per cent. The proceeds of any issue will be utilized to reduce the amount outstanding against the loan facilities.

Since the end of the financial year, the Transvaal and Orange Free State Chamber of Mines has agreed to participate in the financing of the programme of atomic research to be carried out by the Atomic Energy Board.

This programme is estimated to cost £4,000,000 over five years, and the Chamber has agreed that £400,000 per annum will be contributed for five years by uranium producing companies on the basis of the amount of uranium sold by each producer. The initial contribution by this company of £5,808 represented the company's proportion of the sum of £27,410 paid by the Orange Free State joint production scheme for the period April 1, 1959 to December 31, 1959.

FREE STATE GEDULD MINES LIMITED

GOOD progress was made in all spheres of the company's operations during the financial year. The tonnage milled increased by 170,000 tons and the average recovery improved by 1.28 dwt to 15.62 dwt per ton. A total of 94,414 feet was developed, of which 12,895 feet proved payable at an average value of 1,547 inch-dwt. This compares with the development of 90,180 feet during the previous year, of which 13,530 feet were payable, averaging 1,440 inch-dwt.

Substantial Rise in Working Profit

The substantial rise in working profit from £4,049,001 in the preceding year to £5,669,636, made it possible to distribute £4,000,000 as dividends, equal to 8s. 0d. per share, compared with 5s. per share last year.

The excess of expenditure on fixed assets over funds provided at September 30, 1959, amounted to £400,000. Capital expenditure during the year totalled £1,092,899. After taking into account an appropriation of £1,625,976 in respect of capital expenditure and after providing for dividends and sundry small disbursements, the balance of profits carried forward was £410,069. It is estimated that expenditure on fixed assets during the current year will amount to £1,400,000.

At September 30, 1959, the estimated assessed loss for purposes of taxation was £7,675,000.

Members were informed at the company's last annual general meeting that an intersection of the Basal Reef in 45 Level south-west of No. 1 Shaft and south of the dome area, had disclosed extremely good values. By November 30, 1959, a total of 880 feet had been sampled in this area, all of which proved payable at values averaging 6,199 inch-dwt, including all values previously published in respect of this area. These development values, taken in conjunction with borehole results and the good values encountered in development of 41 Level south of No. 2 Shaft, encourage the belief that the south-western portion of the company's mining lease area is underlain by ore of high value.

Considerable difficulty has been experienced in maintaining development in 45 Level on the reef horizon owing to the occurrence of faulting, and extensive diamond drilling has been necessary to determine the approximate elevation of the reef. Before stopping can commence in this area, it will be necessary to effect ventilation connections between 45 Level and the twin haulages now being driven from No. 1 Shaft on 43 Level. This haulage and return airway have now passed beyond a known water-bearing zone to the south of No. 1 Shaft, which hampered progress during the year under review. Advance in both these ends should, therefore, be more rapid during the current year.

The intersection of reef of high value south-west of No. 1 Shaft and the underground borehole and development results previously disclosed, led to the decision to sink a ventilation shaft, to be known as No. 1.A. approximately 4,200

feet due south of No. 1 Shaft. This work was started in 1959, and by November 30, 1959, the shaft had been sunk to a depth of 955 feet. It is anticipated that the new shaft will be in commission to its final depth towards the end of 1961. Initially, the shaft will be divided by a brattice wall into two compartments to provide hoisting and ventilation facilities. Haulages and companion airways from the No. 1 Shaft are being advanced on 45 and 51 Levels and at the end of the financial year the haulage and companion airway on 45 Level had reached the vicinity of the new ventilation shaft. This level will not proceed beyond the new shaft site as a large upthrow fault has been located to the east of No. 1.A. Ventilation Shaft and it has been decided to explore the area south-east of this shaft by an extension of 39 Haulage from No. 2 Shaft. It is anticipated that the cost of this ventilation shaft and ancillary works will be approximately £2,100,000 and that this expenditure will be met from profits.

Drilling Outside Lease Area

During August, 1959, the Basal Reef was intersected at a depth of 4,460 feet in a geological borehole that was drilled near the site of the No. 1.A. Ventilation Shaft. The original intersection assayed 197 dwt of gold per ton over a true reef width of 5.28 inches, equivalent to 1,040 inch-dwt. A deflection, which was incomplete, assayed 166 dwt over a true width of 5.28 inches, equivalent to 876 inch-dwt. A second deflection, in which recovery was complete, intersected the Basal Reef assaying 320 dwt over a true width of 5.28 inches, equivalent to 1,690 inch-dwt.

West of No. 1 Shaft, development in the "dome" area was concentrated on reef and satisfactory values were disclosed. The horizontal borehole drilled in the footwall from 49 Level across the western lease boundary to explore the structure of this area, reached a point 1,510 feet west of the boundary. The information disclosed by this hole and also by a borehole, R.D.2, drilled from surface 1,025 feet outside the western boundary, which passed directly from the Elsburg system into footwall measures, has assisted in clarifying the geology of this area. A further two boreholes are now being drilled from surface: R.D.3, approximately 450 feet west of the boundary, south of R.D.2, and R.P.4, approximately 90 feet west of the boundary and to the north of R.D.2. It can be expected that the results obtained from these boreholes will determine whether it would be advisable to apply for an extension of the lease area beyond the western boundary, as the company is entitled to do.

Further development during the year in the area to the north east of No. 1 shaft has confirmed that values become lower towards the mine's northern boundary. The overall results of payable development at No. 1 Shaft, influenced by the higher footage developed on reef in the rich area to the west and south-west of the shaft, increased from 856 inch-dwt in 1958 to 1,467 inch-dwt in the year.

No. 2 Shaft Values

At No. 2 Shaft the average payable value of development decreased from 1,726 inch-dwt to 1,637 inch-dwt. Good values were disclosed in development in a southerly direction towards the common boundary with Western Holdings, Limited. The ends established in the previous year on 41 Level were also driven in a southerly direction to hole with the haulage and return airway previously developed across the common boundary by Western Holdings, Limited. Raises developed along the full length of this haulage disclosed high values. These raises will be connected in due course with the haulage being developed on 39 Level. In the past year, the haulage and companion airway on this level were developed in a westerly direction, and after passing through the reef horizon were turned to the south where the first holdings with workings above 41 Level were effected. It is expected that the end on 39 Level will reach the vicinity of the common boundary with the Western Holdings' mining lease area during the current financial year.

Underground ventilation conditions in the No. 2 Shaft area have been greatly improved by the bringing into operation of main surface fans in the No. 2 ventilation Shaft, which reached its final depth of 4,827 feet below collar during April, 1959. This improvement has not only made possible further development on the lower levels north of the No. 2 Shaft, but also development to the east of the shaft on the 47 and 49 Level horizons.

Headings are now being advanced on these elevations to obtain more information about the Dagbreek Fault and to determine the reef potential of the area to the east of this fault.

Additional airways are now being advanced to connect existing workings with the shaft acquired from Freddie's Consolidated Mines, Limited, and fans will be installed underground to improve ventilation in the No. 1 Shaft area.

I am confident that, with the improvements in the ventilation facilities throughout the mine, with the exploitation of areas where development during the past year has disclosed reef of high value and provided Native labour continues to be in ample supply, there will continue to be improvements in both the average milling rate and the recovery grade.

High Grade of Ore Reserves

The increase in the total footage developed and the improvement in the development values throughout the mine resulted in an increase in the ore reserve of 331,000 tons to 2,766,000 tons and an improvement in grade to a figure in excess of 1 oz per ton. In comparing the ore reserve figures for the year under review and those for the preceding year, it should be remembered that the footage developed in the high grade area south-west of No. 1 Shaft during the financial year was limited and, therefore, not sufficient to effect any appreciable increase in the grade of the ore reserve. The increase recorded is almost entirely due to development in

the "dome" area west of No. 1 Shaft and from the No. 2 Shaft area.

After a test period of approximately six months, the mine water demineralization plant on the company's property was brought into operation as a produc-

tion unit in May, 1959. Up to date only underground water from the company's mine has been treated. The output increased progressively as additional presses were brought into operation and during November, 1959, 23.5 million

gallons of fresh water were produced and supplied to the Welkom mine uranium plant. The stage has now been reached where revenue from the sale of purified water almost balances the plant's operating costs.

WESTERN HOLDINGS LIMITED

THE company has an outstanding record of achievement in all phases of its operations for the year under review. The additional ventilation that became available when existing workings were connected with the No. 3 Shaft system made possible the opening up of further stope faces from raises already developed in the established portion of the mine. This enabled the company to benefit to the full from the increased supply of Native labour, and operating results consequently showed a marked improvement: the monthly milling rate increased from 100,000 tons in October, 1958, to 137,000 tons in September, 1959. The total tonnage milled, amounting to 1,387,500 tons, was an increase of 218,500 tons over the figure for the previous year, and the average gold recovery grade improved from 10.86 dwt to 12.09 dwt per ton—a rise of 1.23 dwt per ton.

The higher mill tonnage and the improved yield per ton accounted for the increase of £1,761,329 in the working profit, totalling £6,469,617. Average working costs, at 57s. 10d. per ton milled, were higher by 2s. 3d. compared with the previous year's figure, but costs per fine ounce of gold were reduced by 6s. 7d. to 95s. 9d.

The profits earned during the financial year exceeded the total of the amount brought forward as the assessed loss and that portion of the capital expenditure incurred during the year which ranks for redemption for taxation purposes. The company, therefore, became liable for income tax during the last quarter and an amount of £803,000 has been set aside for this purpose. The first lease payments to the State will become due in the current year.

The higher profits earned, together with a small unappropriated profit brought forward from the previous year, were sufficient to finance the excess of capital expenditure over funds raised at September 30, 1958, amounting to £1,200,000, to finance capital expenditure during the year under review of £866,926, and to provide for dividends totalling 8s. 6d. as compared with 7s. 0d. for the previous year.

The unappropriated profit carried forward to the current year amounted to £709,938, compared with £246,607 for 1958. Capital expenditure during the current year is estimated at £1,400,000.

Future Tax Liabilities

Commencing with the current financial year, increased amounts will have to be set aside out of profits to meet not only the company's future tax liabilities but also the State's share of profits in terms of the lease agreement. It is expected, however, that the higher profits, which will result from the expansion programme at present being undertaken,

will be sufficient to finance capital expenditure and offset the effect of tax and lease payments on the prospects of distributing increased dividends in the future.

The extension of the reduction plant to a nominal capacity of 150,000 tons a month has already been completed, and work is now in progress on additional extensions to bring the plant's capacity to 175,000 tons a month. It is hoped to complete these extensions towards the end of the current year. A steady increase in the monthly milling rate should be maintained as additional ore becomes available from the No. 3 Shaft system, where stoping commenced at the end of the year under review.

It is anticipated that the mill tonnage and recovery grade will show further increases. The justification for this view may be found in the latest ore reserve figures. This reserve has increased by 400,000 tons to 4,730,000 tons and the grade has risen from 15.03 dwt in 1958 to 16.01 dwt. per ton.

Values in No. 3 Shaft Area

The improvement in the grade of the ore reserve is attributable mainly to the consistently high values disclosed in development in the No. 3 Shaft area, where a total of 3,535 feet on reef was sampled at an average value of 1,636 inch-dwt. Most of this footage was developed in an area to the east of the shaft on 30 and 28 Levels. A limited amount of development on 28 Level west of the shaft disclosed values corresponding to the average for this shaft.

The haulage on 30 Level, which is being advanced to explore the area west of the No. 3 Shaft, encountered a number of faults which displaced the reef to horizons above 30 Level, and no reef has as yet been intersected. As part of a drilling programme to explore the western portion of the lease area, a series of boreholes were drilled from surface. Borehole F.H.2, drilled approximately 6,000 feet west-north-west of No. 1 Shaft to determine the depth of the reef in the north-western section of the mine near the Free State Geduld boundary, intersected the Basal Reef at a depth of 3,806 feet below surface, and the assay result was 184.3 dwt over a corrected width of 13.1 inches, equivalent to 2,414 inch-dwt. Borehole M.H.1 was drilled approximately 4,000 feet due west of No. 3 Shaft for the purpose of determining the probable position of the sub-outcrop of the Basal Reef and intersected this reef horizon at a depth of 1,595 feet, assaying 0.9 dwt of gold per ton over a corrected width of 5.7 inches, equivalent to 5 inch-dwt. A further two holes are at present being drilled to the north and south of M.H.1, to obtain further information to assist in the delimitation of the sub-outcrop.

The total footage developed during the year amounted to 112,857 feet, which represents an increase of 29,449 feet over the figure for 1958. The greater proportion of this development was undertaken in the area between Nos. 1 and 2 Shafts. As values in this area tend to be lower than those disclosed to the north of No. 1 Shaft, to the south of No. 2 Shaft and in the No. 3 Shaft area the overall payable average value for the year declined slightly to 1,136 inch-dwt, compared with 1,187 inch-dwt for the previous year.

High Values Confirmed

North of No. 1 Shaft a certain amount of development on 43, 41 and 38 Levels towards the common boundary with Free State Geduld Mines, Limited confirmed the high values previously encountered in this area. It is expected that the haulage on 39 Level will reach the vicinity of the Geduld No. 1 Borehole during the current year. A limited footage was developed south of No. 2 Shaft, where the values disclosed continued to be satisfactory.

In my last review I referred to plans for opening up the eastern portion of the company's lease area. On 45 Level at No. 1 Shaft, work preparatory to the sinking of a sub-incline has been completed and at No. 2 Shaft the sub-incline has reached an elevation mid-way between 47 and 49 Levels. Once these sub-inclines are complete, development will be undertaken to determine the extent and value of the reef at deeper levels eastwards towards the Dagbreek Fault. A limited amount of development of the twin crosscuts was undertaken on 43 Level east of No. 1 Shaft. These crosscuts traversed a major fault and, after being turned in a southerly direction, intersected reef disclosing values averaging approximately 600 inch-dwt. It is intended to advance the development in this area in the current year as and when more ventilation becomes available.

The company owns the mineral rights over the farms Pretoriuskraal No. 53, the remaining extent of Doornkom West No. 446, Chrystalkop No. 693 and seven portions of Zuiping No. 394. The company also holds, in perpetuity, all the owners' rights under the Reserved Minerals Development Act and certain other mining rights over the farm Mispah No. 274. These farms, situate in the district of Viljoenskroon, constitute a block of approximately 4,495 morgen adjoining the Vaal River immediately south of the mining lease area of Vaal Reefs Exploration and Mining Company, Limited.

In 1955, this company completed a preliminary prospecting programme in this area and the conclusion was then reached that the borehole values, whilst indicating the presence of some payable reef, did not encourage the hope that any

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immediate exploitation of the area would be justified. Earlier this year it was decided to prospect this ore body further by drilling six additional boreholes, of which three were sited on Pretoriuskraal, one on Doornkom West, one

on Chrystalkop and one on Mispah. As part of the programme, the company also undertook to share the cost of a seventh borehole, G.Z.1, on the eastern boundary of the farm Zuiping No. 394, at a point approximately 5,000

feet south of the Vaal River. This hole is being drilled jointly with Free State Development and Investment Corporation Limited, the owner of the mineral rights over certain adjoining areas to the east.

PRESIDENT BRAND GOLD MINING COMPANY LIMITED

THE company's outstanding progress during the year under review is reflected in the substantial rise in the total working profit to £9,173,025, an increase of approximately 40 per cent over the £6,585,271 earned in the previous year. Of this increase no less than £2,564,592 was derived from gold and £23,162 from uranium.

Increase in Tonnage Milled

The ample supply of Native labour was a major factor in achieving the increase in the tonnage milled from 989,500 to 1,267,500 tons. A large proportion of this tonnage was drawn from the No. 1 Shaft area where average values are considerably higher than in the No. 2 Shaft area. This, in conjunction with the fact that because of the friable nature of the hanging wall, stoping, once started, had to be completed in a number of panels of exceptionally high value, resulted in the average recovery grade improving from 14.89 dwt to 15.75 dwt per ton.

Assuming the supply of labour continues to be satisfactory — and there is every indication that this will prove to be the case — the tonnage milled during the current year should continue to rise as more stope faces become available, particularly in the No. 2 Shaft area. However, the effect of drawing additional tonnage from the No. 2 Shaft area will mean that the average recovery grade will, in future, be more representative of the grade of the mine as a whole.

In anticipation of the increase in tonnage from both No. 2 and, in due course, No. 3 shafts the reduction plant is being extended to a rated capacity of 150,000 tons a month.

Out of the increased working profit, £3,385,500 was provided against taxation and £556,000 as the initial liability for the State's share of profits under the mining lease. An amount of £1,406,943 was appropriated for capital expenditure and £3,861,000 for the payment of an increased total dividend for the year of 5s. 6d. per unit of stock, compared with 5s. per unit of stock in 1958. An unappropriated balance of profit of £422,127 was carried forward to the 1960 financial year.

Expenditure on fixed assets amounted to £2,256,943, including contributions of £180,190 towards the amortization of the uranium plants on the properties of the President Steyn and Welkom gold

mines. Funds provided at September 30, 1958, exceeded the expenditure on fixed assets at that date by £1,750,000. Of this amount, £850,000 was used towards the financing of the expenditure on fixed assets incurred during the year under review, the balance being financed by an appropriation of £1,406,943 from profits. The excess of funds provided at the financial year end, amounting to £900,000, will be available to meet, in part, the estimated expenditure on capital account of approximately £2,700,000 during the current year and the balance will be provided from profits.

The average payable development value throughout the mine declined from 1.294 inch-dwt in 1958 to 981 inch-dwt. This decline was due, on the one hand, to the policy of increasing the footage developed on reef at No. 2 Shaft in order to attain a better balance in the ore reserves; on the other hand, there was also a decrease in footage developed on reef at No. 1 Shaft as a result of the practice, explained in my last review, of effecting raise connections at less frequent intervals. Notwithstanding the decrease in the development values, the ore reserve at the end of the financial year totalled 3,804,000 tons, at an increased grade of 18.14 dwt per ton.

At No. 1 Shaft development was undertaken on all levels to the north and south, and the payable values disclosed, averaging 1.330 inch-dwt, were slightly higher than those obtained in the previous year. Development in the No. 2 Shaft area revealed satisfactory payable values averaging 502 inch-dwt, compared with 557 inch-dwt in 1958.

The headings on 46 Level north of No. 1 Shaft holed through to the Welkom No. 3 Joint Shaft during the second quarter of the financial year. The additional ventilation available from this latter shaft made it possible to increase the development work being undertaken on 42 to 46 Levels north of No. 1 Shaft. This development will provide adequate stope faces to enable production to start from the new No. 3 Shaft system immediately it is commissioned towards the end of 1960.

During the year it became apparent that the President Steyn company would be better able to ventilate the north-western portion of its mine from the company's No. 3 Shaft system than from the Welkom No. 3 Joint Ventilation Shaft. As it would also be of benefit to the operations of this company, it was

agreed to provide for President Steyn's ventilation requirements in the new No. 3 Shaft system in exchange for the latter company's share in the Welkom No. 3 Joint Ventilation Shaft.

The ventilation capacities provided by the company's Nos. 1 and 3 Shafts and by its increased share in the Welkom No. 3 Shaft, should be sufficient to provide adequate ventilation for the exploitation of the northern portion of the mine. In the southern portion of the mine, ventilation has been improved by bringing into operation the main fans at the No. 2D Ventilation Shaft and by cutting ventilation connections on 44 Level to serve the area north of No. 2 Shaft.

The No. 2 Sub-vertical Shaft system was completed to its final depth during the year. The establishment of ore and waste passes is at present in progress and a mid-shaft loading station is being installed. Once this work has been completed, development will be started on 52 to 58 Levels north-east, where long-wall stopes are to be established.

Good Progress at No. 3 Shaft

Good progress has been made in the sinking of the No. 3 Main and Ventilation Shafts, and by November 30, 1959, the shafts had penetrated to depths of 4,081 feet and 3,846 feet respectively. Because of a comprehensive programme of pre-cementation, sinking was not delayed by the inflow of water, even though cement-filled fissures were intersected.

Since the end of the financial year, the Transvaal and Orange Free State Chamber of Mines, representing the uranium producing companies, has agreed to participate with the Union Government and certain industrial concerns in the financing of the programme of atomic research to be carried out by the Atomic Energy Board.

This programme is estimated to cost £4,000,000 over a period of five years, and the Chamber has agreed that £400,000 per annum will be contributed for five years by uranium producing companies on the basis of the amount of uranium sold by each producer. The initial contribution by this company was the sum of £5,242, which was paid on October 14, 1959, and represented the company's proportion of the sum of £27,410 paid by the Orange Free State Joint Production Scheme for the period April 1, 1959, to December 31, 1959.

JOS HOLDINGS LIMITED

The 49th ordinary general meeting of Jos Holdings Limited was held on January 13 in London, Mr. A. B. D. Fox, A.R.C.S. (the chairman), presiding.

The following is his circulated statement:

The results for the year to July 31, 1959, enable a dividend of 12½ per cent. to be recommended. This compares with the equivalent of 10 per cent. last year.

While profits and investment income are at about the same level as previously, the improvement during the course of the year justifies a more liberal distribution without any departure from the conservative policy pursued in the past.

Investments

The quoted investments (which do not include our subsidiary company, Jos Tin Areas Limited) are distributed as follows:

	This year	Last year
	%	%
Government Stocks ...	9	1.4
Dollar Holdings ...	13.5	13.3
Banks and Insurance ...	14.5	12.9
Commercial and Industrial ...	34.5	35.7
Financial Land and Investment Trusts ...	13.8	13.1
Mining Finance, Mines and Oil ...	22.8	23.6
	100.0	100.0

The average market value of the holdings is £5,020 and no more than 5½ per cent of the total is in any one company. Of our funds 96.63 per cent. is in equities. The average yield on market prices at the year end was 4.8 per cent. Some improvement in the investment income can be expected for the current year. The capital position as disclosed by the valuation given on the balance sheet is satisfactory.

Mining

Restriction on Tin production applied during the whole of the year but the severity was progressively relaxed and the market price improved. In addition a small tonnage of Columbite was sold and the demand for this material is better.

A summary of the mining results is given below:—

	Year to 31.7.59	Year to 31.7.58
Jos Holdings Limited and Jos Tin Areas Limited		
The sales of tin concentrate (tons) ...	105	1724
The average price obtained (per ton) ...	£572	£517
The cost per ton of concentrate (including realization charges) ...	£420	£417
The average price of tin metal (per ton) ...	£778	£725

The rise in costs was immaterial but, since the end of the year, a substantial increase in wages has been agreed upon.

Once again our thanks are due to Major Roberts and the Staff in Nigeria and London for their excellent achievements and for the efforts they continue to make on our behalf.

The Report and Accounts were adopted.

JOHN SUMMERS & SONS, LTD.

RESULTS EXCEED EXPECTATIONS

The annual general meeting of John Summers and Sons, Ltd., will be held on February 4 in London.

The following is an extract from the circulated statement of the chairman, Mr. Richard F. Summers:

Before embarking on this statement I refreshed my memory with what I had said at this time last year. I found that under "Future Prospects" I forecast that there would not be any significant increase in our production and deliveries, but that demand would be such that it would enable us to dispose of everything we could make. I also predicted that the financial results would be somewhat similar. In the event it seems that my forecasts were reasonably accurate. If anything the financial results are somewhat better than had been expected. Deliveries of sheets were up by some 40,000 tons, and the demand was very heavy throughout the year.

Company's Future Prospects

We do not expect to see much in the way of increased production during the first half of the year, as we shall be busily engaged in transferring and modifying much of our finishing equipment but we would hope that in the latter half we should begin to reap the benefit of these changes and be able to increase our deliveries, and that by the end of the year the capacity at Shotton would be approaching its target. Our order book is full, and we are anxiously awaiting the time when with increased production we shall be able to meet more nearly the requirements of our customers. We appreciate that during the past year we have been unable to do this, but we tried to avoid misleading our many friends by making delivery promises which we knew we could not possibly have implemented. From the financial point of view we would hope that when we get the larger production we should benefit not only from the increased tonnage, but also from the fact that with all the Departments working at or near their capacity, economies in production costs would result.

On a previous occasion I indicated that at the moment we have no further large scale schemes in mind, but we shall naturally be keeping in close touch with the situation, and will have due regard for any changes in conditions. Preliminary experiences indicate that it may well be the case that the capacities of some sections of the plant which we installed may prove to be in excess of our original estimates. In this event we should give careful consideration as to what steps we could, or should, take to bring up the output in other units to match them. Whenever possible we like to base our plans and estimates of production on our own practical experience. Though this method may take a little longer, sometimes it avoids making what could be costly mistakes, and in the long run we believe produces the best results. Whatever may be the future capacity of the British sheet industry, we are satisfied that owing to its long experience and the comparatively low cost of its modern equipment, this Company will be in a strongly competitive position.

BOARD CHANGES

Sir Eric Speed has been appointed an additional director of Central Mining and Investment Corporation and of its subsidiary Central Mining Finance. Mr. G. V. Richdale has resigned from both boards.

★

Mr. Christopher J. Holland - Martin has been elected a director and appointed chairman of Tanganyika Holdings in place of Sir Ulick Alexander, who has resigned from the board.

★

Mr. G. V. R. Richdale has resigned from the board of Rand Mines.

DAVIES INVESTMENTS LTD., Bankers, still offer 7½ per cent on sums £20 to £500 (withdrawal on demand) with extra ½ per cent on each £500 unit. Details and audited Balance Sheet from Investment Dept. MN, Davies Investments Ltd., Danes Inn House, Strand, London, W.C.2.

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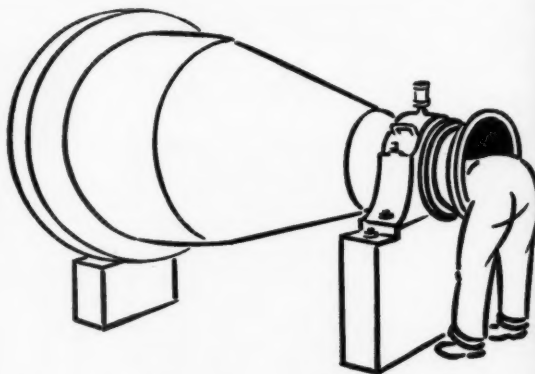
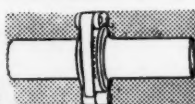
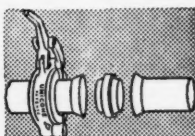
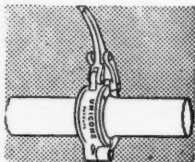
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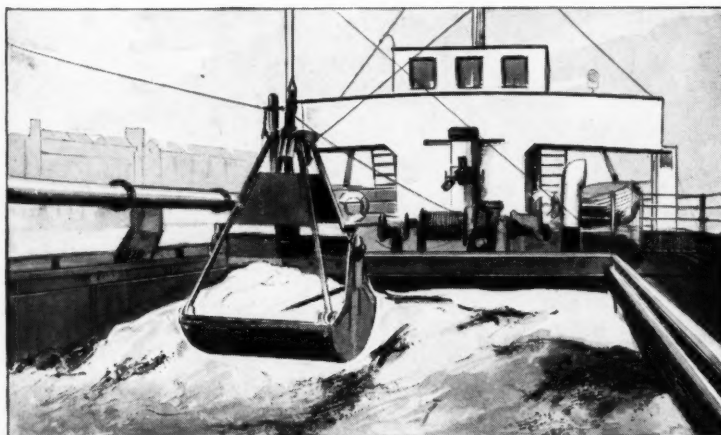
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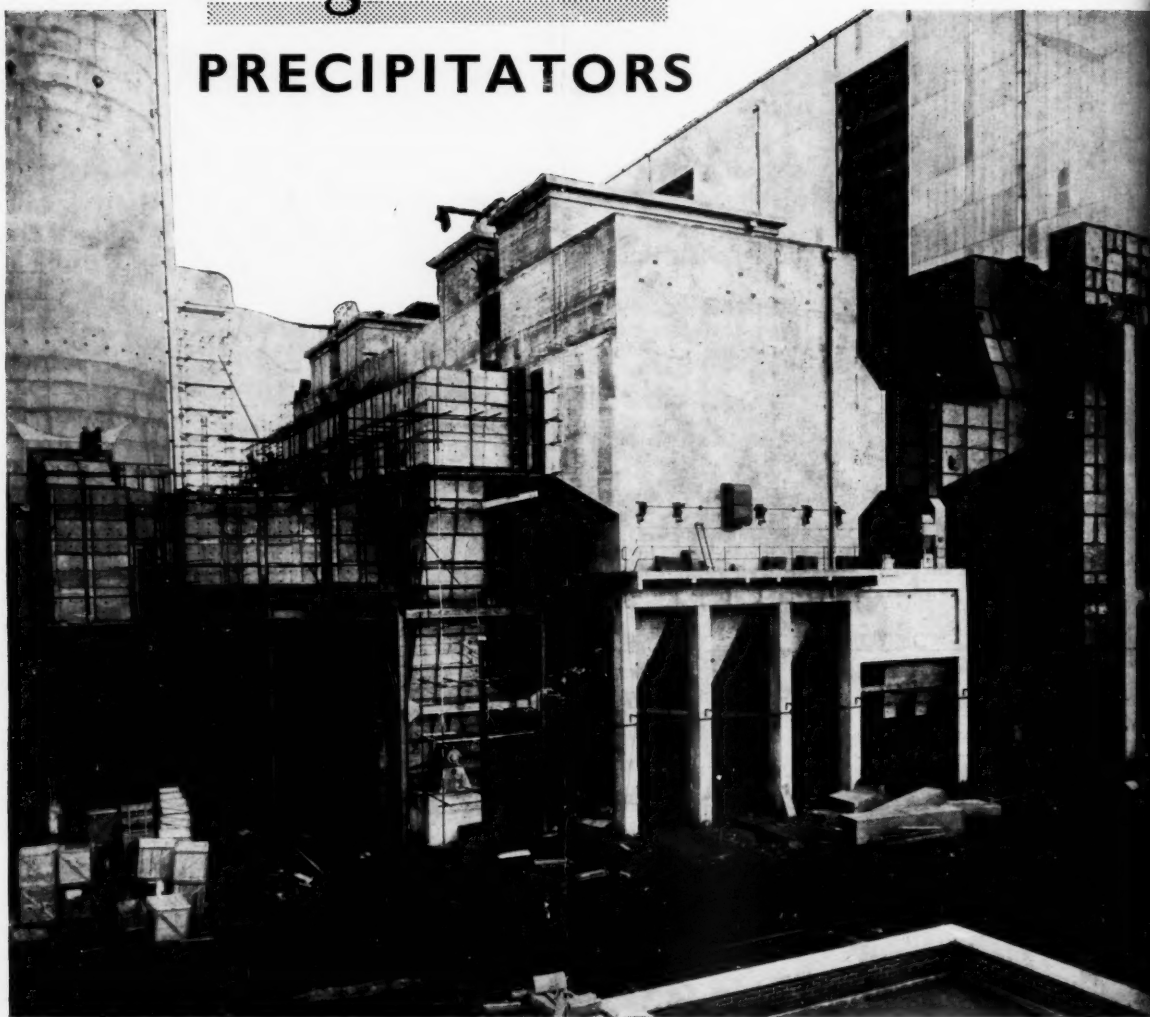
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